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The Whole Truth—Not Selected Truth

R. H. STINCHFIELD, *Editor*

Editorial Office: 1155 16th Street, N. W., Washington 6, D. C.

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Southern "Christmas" Trees

Better Crops with PLANT FOOD

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Let's All Give . . .

A Toast to the Holidays

Jeff McDermid

CHRISTMAS "at the turn of the century"! What a queer, long-ago sound that is to the younger generation we try to enliven with a few ancient anecdotes and rusty reminiscences as the precious holiday tide rolls in once more. When we were fresh-visaged and joyous away back then, pursuing customary whims and pleasures, and doing allotted chores about the snug household, that portentous phrase—"the turn of the century"—held little of the nostalgic sadness and mellow memory which its cadences call forth today.

Things were vastly different in material and physical ways from the things we have become accustomed to through the intervening years; and for the most part, this is just as it should be. It's in the intangible realm of the spirit and the emotions that the split with the old days seems hardest to accept and understand.

None of the winter holidays at the turn of the century were so apt to seem like a lull in the midst of a terrific, world-engulfing hurricane. Life in our small towns and in the open countryside was relatively calm and quiet. Boys and girls looked forward to a certain degree of destined normal expectancy and reasonable hope. Social security as a problem for federal or professional regulatory solution was unknown. The only pensions paid out were doles of small dimensions made to veterans of our own nearby wars—and then only after taking each case to congress, plus fees to a stuffy pension advocate. No case of velvet living on

taxpayers' charity shocked the daylights out of our serenity.

So I say, we hanker not after the so-called "comforts" and near-luxuries that were the gaslit boast of an era which is laid to rest in reverence along with the family buggy and the parlor heater. Here and there reminders of its existence come to light in the freakish revivals inspired by a roving and canny clan of antique merchants. Their days are spent collecting and dusting off faded and forgotten "pretties" to be sold at a wide margin to curio hunters and seekers after unusual gifts. But as I stand in their mucksy and jumbled emporiums and scan this loot, I recoil. It all looks embalmed and spiritless. I myself would look the same if I tried to grow the beard and sideburns so essential to masculine adornment when this century was "turning."

In other words, after a session amid their wares I wonder if perchance all of us who were beginners in the 1900's are not awful examples of the Early American—fit mostly for a place on the shelf. At least we are genuine and not a factory-made imitation.

OF course, the snow still falls, the seasons come and go, the birds sing as well as they ever did before for those who listen, boys and girls hasten too fast into men and women, kids are born and raised as usual (with extra frills), and the holly berries and mistletoe are as charming and provoking in their symbolism as ever. Folks still enjoy the privileges of toasting each other in tom-and-jerry, and pass their china plates too many times for more of that festive goose and gravy.

When daily cares "cark" us and the hours seem long and dull, it is still our privilege to partake of a "little slumber, a little folding of the hands in sleep." We know the thrill of getting warm after frost-bites and the joy of rising and stretching for a vigorous and purposeful day of doing. Yes, the main experiences have not changed with time.

By and large, the little mid-country towns and farmsteads are rousing spots for our holiday observances, without much inward alteration. Outwardly, though, something "has been added." The wood blocks in the village paving are now concrete highway. The seasonal light and color are seen in streamlined show windows and in glittering electric signs and street-lighting effects. The closest resemblance to the evening darkness of my old home-town's environment is a number of the alleyways in our largest cities. Rural America is on her way.

Inwardly, as I said, things are the same. Our hearts are as warm and good will is as rampant now as it was in the era that is ended; in some ways, even more. Take our attitude toward all manner of financial and community assistance to victims of misfortune—to say nothing of the generosity unknown in the life of fifty years ago—generosity toward people we have never seen and countries we have never visited.

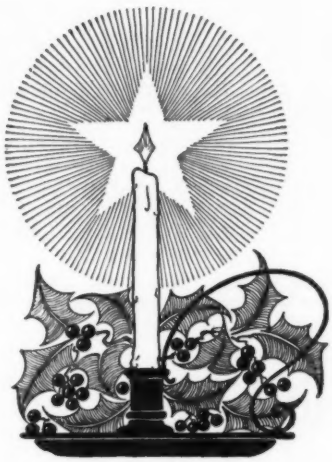
You can make quite a contrasty case out of that idea. Away back in 1900, America was scarcely emerging from a lone outpost of experiment to a position of world power. Much was left to do before we had a secure foundation on which to blazon forth with all the new marvels and inventions which have been discovered or perfected in our time. Thus our leaders had little chance, if they wished, to become chummy and lend-leasy with our small, new bank balances. Charity began at home, although it was a differently run affair than that we operate today.

Unfortunates and the disabled economic wrecks had but few choices. They either went to fraternal lodge homes, camped out in some odd room with their kids, or packed their few possessions and bundled off to the drab and stark environs of the county poor farm and asylum combined. Besides, folks grew older faster and gave up quicker than they do now.

Being so practical about the relief cases at our doorsteps, and very searching indeed about war pensions, it could hardly be expected that American democracy could afford to waste its initial

substance to send dried eggs, skim milk powder and technical know-how to the Chinks, the Micks, the Dagoes, and the Hottentots.

There were always notable exceptions. Our sympathy and timely succor went abroad several times to salvage victims of flood and famine, even as far away as China and Japan. Our ardent church missionaries proved to be our



best ambassadors in many ways, bringing medical and sanitary aid to far-off spots seen rarely even in our tiresome geographies.

IT'S always been a wonder to me that our pioneer country church was able to find any surplus funds to outfit and support these foreign missions. It probably traces to the ladies auxiliaries and the like do-good outfits, who did more with less than seems believable. The individual worshipers in most of the rural churches had small and uncertain incomes. Few of them were commercial farmers. Self-sufficiency and live-at-home methods in agriculture meant dull days and small profits for the country tradesman. I recall the dime that my Dad placed in the plush bag on a stick shoved under his nose between the prayer and the sermon. When wages were a dollar a day of twelve hours, tithing was tough. So you couldn't be blamed much for skimming the milk of human kindness a little, or counting the coppers carefully. Sure, you trusted Providence, but you also had to be provident yourself or lose your shirt.

What the heads of families did was skimp on money matters and act freely and fully in putting their shoulders to the wheel round about them. It was like the difference between forking over cash for taxes on one hand, or doing as they used to—driving team or handling shovels in road repair. You hesitated with your purse but "histed" with your muscles and your time. Nowadays folks prefer to buy themselves out of a corner in charity and let the hired dispensers represent them. I'm sorry money is cheaper than cooperation, but it can't be helped.

Perhaps this is one reason why we fail to get the same old kick out of Christmas and New Years as we used to when so much muscular work and outdoor zestful exposure sharpened our sense of home comforts and the tip of an evening toddy. We had to make our own pleasures and conveniences the hard way. If you lacked what it took for anything nice and comfortable, no handy store or service shop was within easy hiking or motoring distance.

Sometimes I get into a dither wondering what I would do and how I would act if suddenly it were possible for me to be translated back there bodily to the home town of yore, returning to help them celebrate Christmas. Going back through those dim times again, all too aware of what progress had brought, and accustomed to the modern whirl and complexity, how could I tell them what had transpired or make them understand the viewpoints and the acquired prejudices of an unknown era?

I'll be bound that I'd seem like a snob, unless I kept my mouth shut. Otherwise I'd put both feet into it every time I started to yawp advice or make suggestions to those dear, old-fashioned people. I know one or two actual, existing towns in my vicinity this very year where progress has been slow and

(*Turn to page* 49)

Courtesy Univ. of N. H. Visual Service

Fig. 1. Harold Bodwell farm, Kensington, N. H., 1950 Green Pastures winner in New Hampshire, on the day of the New England judging. This field was cut early for hay and later used for young stock pasture.

Surveying the Results of a Green Pastures Program

By Ford S. Prince and George B. Moore

Agronomy Department, University of New Hampshire, Durham, New Hampshire

THE Green Pastures Program, which was conceived in New Hampshire in 1947, spread to all of New England in 1948, and which has since been adopted in many other states, has developed into a program of prime importance for teaching good pasture management practices. Nor does it stop with the pasture program, for in most regions of the United States the pasture program and the whole roughage program are so inseparably linked that one cannot be well developed without the other being affected.

This statement is particularly true of the Northeast region, since much of the pasturing here is done on tillage land. When a farmer seeds a field, he may not know whether he will use it for hay or pasture. In fact, we have stopped talking about hay mixtures and pasture mixtures in most cases unless a field is too rough to plow frequently, in which case a pasture mixture might be advised. Or, if a field is too far from the barn to pasture conveniently, a hay mixture is usually seeded; but by and large, hay-pasture mixtures are now the rule rather than the exception.

Pasturing field land has involved many changes in the farm management program, changes which take some time to put into operation on any individual farm. For this reason, and because farmers are often slow to make drastic changes, particularly those in

the older age groups, not all those who have embarked upon this new pattern of hay-pasture production have the program in full swing. The new pattern places less dependence upon permanent pasture areas and more on hay-pasture production on field land. Furthermore, those farmers who have achieved the highest success with the new pattern are placing more emphasis upon maintaining a high level of fertility, supplementing farm-produced manure with relatively large quantities of commercial fertilizers. Besides these factors, more dependence is being placed upon legumes, particularly upon those of a perennial nature, notably ladino clover and alfalfa.

These changes in hay-pasture production have been forcibly emphasized by the Green Pastures Program. The men who stood at the top of the program, and whose practices have been developed to a high point of efficiency, have been written up in various magazines and their methods have been widely publicized at meetings, in motion pictures, and in other ways.

Here in New Hampshire, we have been much interested in the methods of these top men, but we have been interested also in those farmers who have not developed their programs so that they get a high score when their farms are judged. We have been attempting to find out how the practices of the low scoring men differed from those whose scores were high, and to find out as well whether the methods of these high scoring farmers result in lower feed costs and a greater net return to the farmer.

To this end, during the spring of 1950 a survey was made of an equal number of farmers in each of the three score groups which we have used in our State, those whose scores according to the judges ranged from 85 to 100, which was our top score group, those whose scores ranged from 70 to 84, or the intermediate group, and those whose scores fell in the 60 to 69 range. None of those farmers whose scores were below 60 were included in this survey. When completed, 79 farm records were available for study. The survey was made by the County Agricultural Agents of New Hampshire, and the data therefrom were summarized in the Agronomy Department of the University of New Hampshire.

The data in Table I gives a picture of the farm enterprise, including the number of cows and the total number of animal units, together with the amount of tillage and permanent pasture land the average farmer in each group had at his disposal.

It will be noted that the farmers in the top score group were keeping more cows than those in the other two groups. Likewise, the farmers in the top score group had a larger total acreage, although in point of total feed crops per animal unit the farms in the 85 to 100 score group had a lower acreage than those in the lower score groups.

TABLE I

	Score Groups		
	85–100	70–84	60–69
Number of cows	30.11	20.41	19.40
Total animal units	43.01	28.12	26.56
Tillable acres per farm	96.2	68.65	62.67
Tillable acres per animal unit	2.24	2.44	2.36
Acres feed crops per animal unit	2.10	2.25	2.32
Permanent pasture per animal unit	1.09	1.13	1.50
Improved permanent pasture per animal unit	.30	.35	.25

This reflects the opinion of several close observers that, by and large, the men with a limited acreage per animal unit are doing a better job and growing more roughage per acre than those with a larger acreage for each animal unit on the farm. These data indicate, too, that the farmers in the lower score groups have a larger relative acreage of permanent pasture than those men who had a higher score, indicating that they are still placing more dependence upon this kind of pasture than the higher scoring farmers.

Since all of the men in the survey had been enrolled in the 1949 Green Pastures Program in New Hampshire, it was to be expected that farmers who were improving their permanent pasture as well as the productivity of their field land would be found in all the groups. This fact is brought out by the data in Table I.

One might judge from Table I that there isn't much difference among the farmers in the three score groups. All of them, no doubt, are working for better pastures and all have taken some steps to improve their roughage situation. While the differences, aside from size of business, are slight, they do indicate a significant trend which becomes clearer in the succeeding data.

In the judging program, which was done on all these farms, considerable attention was paid to the mixtures in the hay and pasture fields. The acreage of ladino clover a farmer had and how it looked when the judges came to the farm, whether it was divided up for rotational grazing, etc., all had some influence on a farmer's score. One reason why these farms were arranged as they were in the various score groups, then, depended upon the acreage of ladino or alfalfa, or a mixture of the two, in grass associations, of course. The figures in Table II are highly significant, showing as they do an acre of ladino-alfalfa per animal unit on the top farms, about three-quarters of an acre on the farms of the intermediate group, and just under a half-acre on the farms of the low scoring group.

It wouldn't be surprising if the farms in the low and intermediate score groups were forging ahead and that they hadn't yet reached at the time of

TABLE II

	Score Groups		
	85–100	70–84	60–69
Acres ladino per animal unit	.55	.33	.28
Acres alfalfa per animal unit	.06	.06	.07
Acres alfalfa and ladino mixed per animal unit	.39	.34	.12
Total acres per animal unit	1.00	.73	.47

TABLE III

	Score Groups		
	85–100	70–84	60–69
Tons fertilizer per acre	.19	.07	.07
Tons fertilizer per animal unit	.42	.17	.16
Tons lime per acre	.33	.22	.29
Tons lime per animal unit	.74	.54	.70

Courtesy Univ. of N. H. Visual Service

Fig. 2. Discussing the Bodwell pasture program. Left to right: Stanley Owens, Conn. judge; Guy Angell, N. H. judge; Jimmy Purington, county agent; Harold Bodwell, N. H. pasture winner; and Seeley Reynolds, Vt. judge.

the survey the peak of perfection which the farmers in the top score group had achieved. Ladino clover is relatively a new crop, and it is the acreage of ladino which makes the big difference in these figures.

The use of fertilizer and lime, too, indicates that the farmers in the top group are paying more attention to the fertility of their soils to bring them larger yields and to maintain a higher percentage of legumes in the stand.

Here again, the biggest difference in fertilizer usage was between the top group and the other two groups, with very little difference between the intermediate and low scoring groups. Actually, the amount of lime used by the average man in the low group was greater than that for the intermediate group.

In respect to other practices, some of the factors seem to be significant, while others do not. One of the things usually considered important in dairy farming

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TABLE IV

	Score Groups		
	85–100	70–84	60–69
Corn silage per animal unit, tons	2.04	1.76	1.08
Grass silage per animal unit, tons	1.00	1.06	.36
Total silage per animal unit, tons	3.04	2.82	1.44

Fig. 1. Here is a field of Clinton oats on the Green County Hospital farm, Monroe, Wisconsin, where with 33 pounds of nitrogen the 0-20-20 plot yielded 124.6 bushels per acre and no lodging occurred.

Higher Fertilizer Applications Recommended in Wisconsin

By C. J. Chapman

Soils Department, University of Wisconsin, Madison, Wisconsin

A new series of fertilizer demonstrations was started in Wisconsin in 1948. These trials were carried out in cooperation with county agents in some 50 counties. I called them "Rate-per-acre" demonstrations on small grain and seedings of alfalfa and clover.

Last year (1949) and again this year (1950) we checked the residual effect on the hay crop of fertilizer applied with the grain nurse crop in 1948 and 1949. Just as we had hoped would be the case, the actual values of increases in yields of hay when added to increases of grain and straw and calculated over to a profit-per-acre basis have been greatest in most cases on the plots which received the double rate, 500-pound-per-acre treatments.

Further evidence to show that Wisconsin farmers can profitably apply fertilizers at heavier rates than are common to present farm practice has been gathered from our "whole farm" type of demonstration set up on some 400 farms and carried out over a period of the past 10 years in cooperation with the Tennessee Valley Authority. The yield data secured from these hundreds of large-scale demonstrations have given us some rather conclusive information. It has been shown that 500 pounds per acre of high-potash fertilizer will produce fine crops of alfalfa;

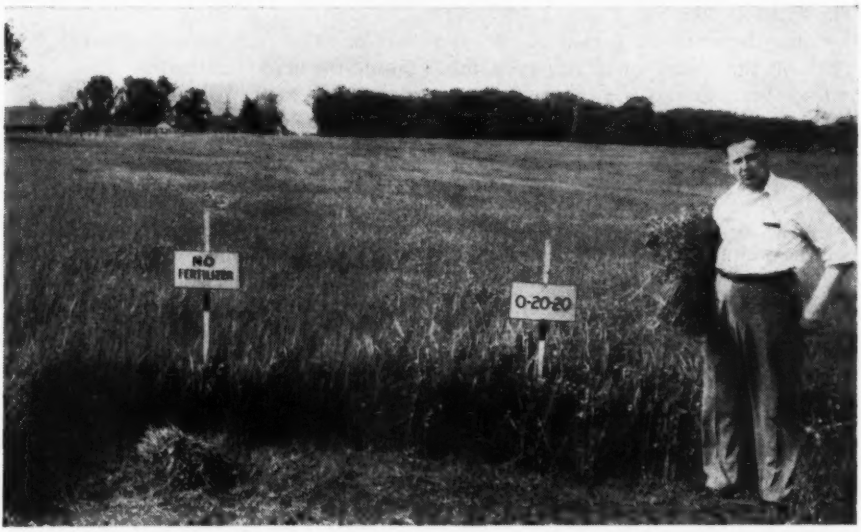

Fig. 2. This is the same field as shown in Fig. 1, but here we see the residual effect of the fertilizer on the hay crop.

and in the wake of good crops of alfalfa and clover have come better crops of corn and grain.

Still further evidence that farmers can profitably apply fertilizers at heavier rates per acre has been gathered in recent years from the experimental plots set up by Professor Emil Truog and his research assistants in Barron, Clark, and Dodge Counties.

And so my first positive statement based on the yield data from all these field demonstrations and experimental plots is: "Wisconsin farmers can afford to apply commercial fertilizer at somewhat heavier rates per acre than are now being used."

My second positive statement based not only on our recent work but on the results of several hundred demonstrations carried out over a period of the past 17 years is as follows: "Wisconsin soils need potash in increasing amounts for maximum yields of clover and alfalfa."

Let's look up some of the evidence.

TABLE I.—AVERAGE YIELDS FOR 30 PLOTS (29 COUNTIES) WHERE RATE-PER-ACRE DEMONSTRATIONS WERE SET UP IN 1948 AND 1949 AND WHERE THE RESIDUAL CARRY-OVER BENEFIT TO THE HAY CROP IN 1949 AND 1950 WAS CHECKED.

Treatment	Average yield grain '48–'49 [1]	Average yield straw '48–'49	Value of increase grain & straw	Average yield hay '49–'50	Pounds increase hay	Value of incl. grain, straw & hay [2]	Cost of fertilizer [3]	Net profit per acre
250# 0–20–0....	59.9 bu.	2612#	$10.14	5429#	858	$20.86	$ 6.24	$14.62
500# 0–20–0....	65.5	2691	14.30	6064	1493	32.96	10.62	22.34
250# 0–20–20...	65.3	2632	13.96	6099	1528	33.06	9.62	23.44
500# 0–20–20...	65.2	2653	13.99	6769	2198	41.46	17.37	24.09
No Fertilizer....	48.1	1984	.....	4571	.....	.....	.....	.....

[1] These are average yields for all plots, both with and without nitrogen.
[2] Oats figured at 70 cents per bushel, straw at $6.00 per ton, and hay at $25.00 per ton.
[3] Represents the average cost of treatments, both with and without nitrogen.

The data shown in Table I indicate that the benefits of potash show up more on the clover or alfalfa crop the second year than on the grain crop the year that seedings are made. Furthermore, it will be observed that the double-rate (500 pounds per acre) treatments of 0-20-20 gave substantial increases in legume hay yields over the 250-pound treatments. There was a gross value of $41.46 for increases in the yields of hay, grain, and straw for the double-rate treatment versus a value of $33.06 where the fertilizer was applied at 250 pounds per acre.

I know you will say, "Wouldn't it be a good idea to topdress alfalfa fields where the light-rate applications were made at the time of seeding down?" My answer is yes, by all means. In fact we have been recommending the topdressing of these old, established fields of alfalfa with high-potash mixtures for several years. And this brings up the question of just how far we can go with heavy-rate applications at the time of seeding down. It may be wise to limit the amount of fertilizer which we apply when seeding down legumes. We know there is some "luxury" consumption of potash by the grain crop and even by first-year alfalfa hay where very heavy-rate treatments of high-potash fertilizers are made at the time of seeding. And too, there is considerable "fixing" of both phosphate and potash in certain soils.

But again, one thing I'm sure of, and that is: The present conventional 250-pound-per-acre treatments should be stepped up to at least 400 or 500 pounds per acre. Furthermore, I am convinced that more potash should be used in our fertilizer mixtures at the time of seeding down to alfalfa. Table II tells the story regarding the need for potash.

But now, what about nitrogen fertilizers for small grain? There is no question in my mind about the profitableness of using some nitrogen on at least a part of our small grain acreage in Wisconsin. On soils where there is little or no danger of lodging, we are recommending up to 33 pounds per acre of nitrogen (equivalent to 100 pounds of ammonium nitrate). But treatment with liberal amounts of phosphate-potash fertilizer and the liming of soils up to a pH of 6.5 (slight acidity) are prerequisites to our recommendations of nitrogen for grain where seedings of clover and alfalfa are made. Why do I make this statement? Because there is danger of smothering the seedings of clover and alfalfa due to the heavy growth of straw resulting from the nitrogen treatment. However, I am convinced (and my statement is backed up by actual field trials) that where the soil is abundantly supplied with minerals (lime, phosphate, potash) the seedling alfalfa or

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TABLE II.—RESIDUAL CARRY-OVER BENEFIT TO HAY CROP (18 YEARS INCLUDING 1950) SHOWING TOTAL AVERAGE VALUE OF HAY, GRAIN, AND STRAW, AND PROFIT OVER COST OF FERTILIZER (226 PLOTS). FERTILIZER APPLIED AT THE TIME OF SEEDING.

Treatment and rate per acre	Average yield grain [1]	Average yield straw	Value of increase grain & straw	Average yield hay	Pounds increase hay	Value of incl. grain, straw & hay [3]	Cost of fertilizer	Net profit per acre
1. 263# 0–20–0	55.5 bu.	2574#	$12.86	4921#	1304	$29.16	$4.37	$24.79
2. 263# 0–20–20	59.8	2746	16.95	5665	2048	42.55	7.89	34.66
No Fertilizer....	42.0	2018	.....	3617	.....	.....	.....	.....

[1] Includes plots for 1948 and 1949 both with and without nitrogen.
[2] Includes some plots receiving 0-20-10, also the 1948 and 1949 plots, both with and without nitrogen.
[3] Grain figured at 85 cents per bushel, straw at $5.00 per ton, hay at $25.00 per ton.

Fig. 1. High winds are capable of lifting and transporting great distances large quantities of dust composed of the organic matter and silt and clay fractions of the soil—the life-giving substances of the soil. This sorting process adds to the general sandiness and depletion of the soil productivity of the area.

Erosion Removes Plant Nutrients and Lowers Crop Yields

By J. H. Stallings

Research Specialist, Soil Conservation Service, USDA, Washington, D. C.

VAST improvements have been made in the science of crop production during the last 60 to 75 years. Inorganic fertilizing materials have been and are being constantly improved both as to the content and availability of nutrients and the physical properties of the product. Rates of fertilizer application have been increased enormously in many areas, and the number of farmers using fertilizer has increased many times over. Better adapted and higher-yielding varieties of crops have been developed through plant breeding and other work in the plant sciences. Improved methods of crop and soil management have been made available. Better materials and equipment for control of insect pests and diseases have been developed.

These and other related developments would have brought about large increases in per-acre crop production if the fertility of the soil had been maintained. If the productivity of the Nation's soils that prevailed when they were first put under the plow had been maintained at or near its former level, the average per-acre crop yields should have shown steady and consistent increases. It has been estimated that acre yields for most of our principal crops

should have increased as much as 40 to 60 per cent during the last 50 years. Actually, the increase of some crops has been much less than this. The national average acre yield of corn and cotton, for example, increased but very little up to 1938 as shown in Table I. Since then there has been some increase in the average acre yields of these crops.

TABLE I.—NATIONAL AVERAGE ANNUAL ACRE YIELD OF COTTON AND CORN BY 10-YEAR PERIODS BEGINNING WITH 1869 AND ENDING WITH 1948.

Period	Average annual acre yield	
	Cotton lint	Corn
	Pounds	*Bushels*
1869–78	171.6	25.9
1879–88	172.5	25.8
1889–98	191.3	26.0
1899–08	187.7	27.4
1909–18	183.3	25.8
1919–28	162.6	27.0
1929–38	198.0	23.0
1939–48	256.0[1]	33.0

[1] Average for the 9-year period ending with 1947

The recent increases coincide with a combination of agricultural advances which were greatly stimulated as a result of the war effort—increased spread of conservation farming and, for corn, the advent of hybrid varieties.

Cotton acreage was greatly curtailed in the old cotton-growing area and expanded into new territory in the Southwest. In the Southeast, better lands were selected for cotton production and the rate of fertilization was stepped up appreciably along with a tremendous expansion in the planting of legume cover-crops and in other improved soil-conserving practices. Perhaps the advent of hybrid corn was the greatest single factor contributing to the recent increase in corn yield. As with cotton, the amount of fertilizer used on the crop during this period was greatly increased and efforts toward the adoption of better farming practices in general were intensified.

A more or less steady decline in soil fertility has largely, sometimes entirely, offset the many advances and improvements made along the line of agricultural production. This is illustrated by the average per-acre yields of eight of the more important crops grown in Michigan during the period 1871 to 1940 (Table II).

With the exception of wheat and potatoes there was no appreciable trend of increase in the yield of any of these crops in the 70-year period, whereas an actual decline occurred in some of them.

Analyses of old cropped or eroded Willamette Valley soils in Oregon, when compared with native sod land, have shown definite reductions in plant nutrients and an increase in soil acidity (14)[3]. The decreases in nitrogen, cal-

[3] Figures in parentheses refer to literature cited.

TABLE II.—AVERAGE ANNUAL YIELDS OF EIGHT CROPS IN MICHIGAN FOR 70 YEARS BY 10-YEAR PERIODS, IN BUSHELS PER ACRE.[1]

Crop	1871–80	1881–90	1891–1900	1901–10	1911–20	1921–30	1931–40
Wheat	15.0	14.9	14.0	15.6	16.9	19.5	20.4
Corn	33.4	27.5	30.0	32.2	33.3	30.4	32.6
Oats	21.9	31.9	29.7	31.3	34.0	31.0	31.0
Rye	14.4	12.2	13.6	15.0	14.4	12.9	12.3
Buckwheat	16.1	12.9	14.2	14.4	14.1	12.0	14.2
Barley	22.9	22.7	22.0	25.0	25.2	23.9	24.8
Potatoes	86.0	73.0	80.0	89.0	90.0	97.0	97.0
Tame hay[2]	1.21	1.22	1.21	1.33	1.28	1.12	1.27

[1] Data from L. M. Turk, Department of Soil Science, Michigan State College.
[2] Yield expressed in tons per acre.

cium, and sulphur were as much as 50 per cent, and the lime requirement increased about one-half to three-fourths ton an acre. It is estimated that the soils of the Willamette Valley sustain a net annual loss of 29,000 tons of nitrogen and a heavy loss of potassium, sulphur, calcium, and magnesium, ranging from 2,500 to 106,000 tons annually. The annual loss of nutrients is from 2 to 17 times the amounts returned to the land, depending on the kind of nutrient.

The immensity of plant-nutrient losses due to erosion is indicated by the amount of silt and nutrients carried in the water of the Tennessee River system. For example, on the assumption that this silt came entirely from the row crop, idle, and other land subject to severe erosion, it has been estimated that the loss from each acre of such land during 1939 would average 5.2 tons of silt, 84.6 pounds of CaO, 97.9 pounds of MgO, 212.2 pounds of K_2O, 13.0 pounds of P_2O_5, and 23.8 pounds of nitrogen (6). Calculated on the basis of the total acreage of the watershed, the average acre losses of the three bases, as oxides, carried in solution were 167.0 pounds of calcium, 31.7 pounds of magnesium, and 7.1 pounds of potassium.

The estimated losses from the land in the entire Mississippi River basin during the same period averaged 1.9 tons of silt, 43.6 pounds of CaO, 53.8 pounds of MgO, 55.6 pounds of K_2O, 5.08 pounds of P_2O_5, and 6.46 pounds of nitrogen per acre of open farm land. On the basis of the total acreage in the watershed the average acre losses were .6 ton of silt, 13.6 pounds of CaO, 16.9 pounds of MgO, 17.4 pounds of K_2O, 1.59 pounds of P_2O_5, and 2.03 pounds of nitrogen.

The amount of mineral nutrients contained in the drainage waters of the Tennessee River watershed varies with the nature of the stratum from which the waters flow. The water draining the limestone areas contains the greatest amount of total mineral matter and that from the sandstone areas the least. However, the drainage waters from the sandstone areas contain more than twice as much potassium as the drainage waters from the limestone areas (11). The amount of phosphorus in the drainage waters varied with the amount contained in the soils from which the water flowed.

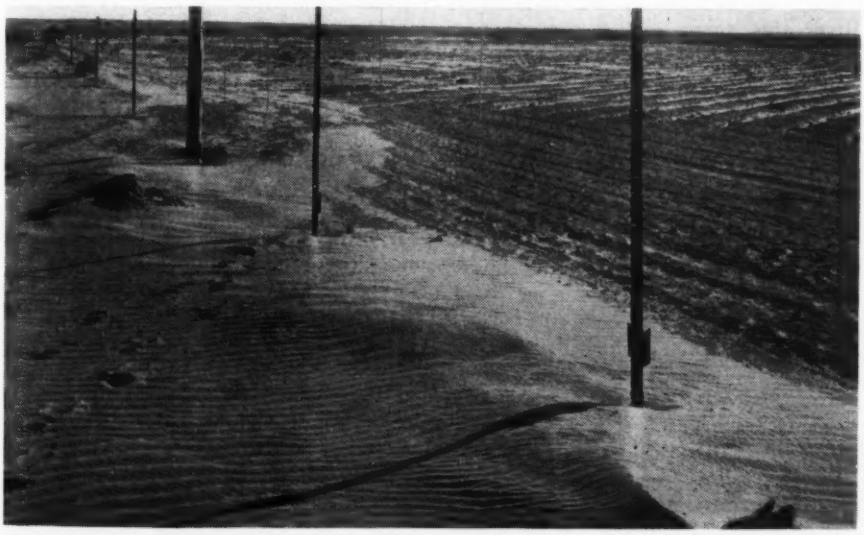

Fig. 2. The portion of the field in the foreground was blown out to a depth of more than 12 inches. Sand and coarser materials were blown into drifts and dunes.

The waters draining the highly phosphatic soils of the bluegrass area contained the greatest amount of phosphorus. The greatest amount of nitrate nitrogen was found in drainage waters containing the largest amount of soluble phosphorus, thus indicating the close relation between soluble-phosphorus and nitrate-nitrogen content.

The amounts of nutrients carried annually in solution by the Mississippi and Ohio Rivers are shown in Table III (11).

TABLE III.—AMOUNTS OF PLANT NUTRIENTS CARRIED IN SOLUTION ANNUALLY IN THE OHIO AND MISSISSIPPI RIVERS.

Element	Ohio River [1]	Mississippi River [2]
	Tons	*Tons*
Phosphorus	17,199	62,188
Sodium	119,446	630,720
Potassium	396,521	1,626,312
Calcium	6,752,222	22,446,379
Magnesium	1,629,319	5,179,788
Sulphur	2,229,544	6,732,936

[1] At confluence with the Mississippi River.
[2] At Baton Rouge, La.

In addition to the mineral nutrients carried in solution by the Mississippi River, this stream carries in suspension 7,469 million cubic feet of soil annually.

Erosion removes large quantities of plant nutrients from the soil, and much larger amounts of nutrients are lost by this means from certain productive soils than from less productive ones (18). For example, Muscatine soil in Illinois lost 311.4 pounds of calcium per acre in 3 years and 8 months, or a little more than 27 times as much as Cowden soil which lost 11.5 pounds in the same time. The nitrogen loss during this period was 280.9 pounds per acre on Muscatine soil as compared with 14.2 for Cisne soil. Magnesium losses were not as high as those of nitrogen or calcium but showed the same general relation to soil types. There was only a slight loss of potash from any of the 10 soil types studied. The greatest loss was 5.0 pounds from Muscatine soil and the smallest was 1.8 pounds from Osceola soil.

Soil erosion has played, and continues to play, a major role in impairing the productive capacity of the Nation's soils. Organic matter, nitrogen, and the clay and silt fractions of the soil, which contain the life-producing nutrients, are removed by the erosive action of wind and water. The selecting and sorting action of these agencies separates the lighter materials from the coarser and heavier sand particles and carries them off, leaving the more inert and less productive material behind. If erosion is severe the body of the soil itself is carried off.

Depletion of fertility in crop land is brought about by the combined action of many factors. Annual cropping removes large amounts of nutrient materials. Soluble constituents are lost through leaching processes. Organic-matter decomposition as a result of microbial activity proceeds at a rapid rate in cultivated soils. In addition to these and many other factors, the process of erosion is now recognized as one of the most serious forces in the rapid depletion of fertility and productivity of cultivated lands.

Much experimental evidence is available to show the extent to which erosion carries away the life-producing part of the soil—the part that contains the nitrogen and mineral plant nutrients essential to plant growth.

The light-weight particles of soil are the important ones in the great new dry land winter-wheat belt of the Southern High Plains (5). It was the loss of such particles during the dust storms of the 1930's that opened the way for serious inroads on the fertility reserves of the soils in this area. The first soil drift of 1933 to lodge in a fence row on the Panhandle Experiment Station at Goodwell, Oklahoma, contained 24.6 per cent of organic matter. The drifted soil had been separated by wind from the surface of topsoil averaging less than 2 per cent organic matter. Removal of the rich topsoil lowered crop

Fig. 3. Much of the topsoil was removed from this field by a heavy rainstorm. The deposit in the foreground consists of the sandier and coarser portion of the soil eroded.

yields 4.5 times as fast as did later removals of surface and subsoil material.

Each shift of soil by the wind serves to remove more plant nutrients. After the soil is shifted a large number of times, the remaining soil that forms the dunes is mainly sand, regardless of the original texture (3). In Oklahoma, after the heavy wind storms of the early 1930's, the organic matter-nitrogen ratio in the cropped soil was 22.47, that in the virgin soil 23.30, and the average of the drifts was 24.44. As a result of cropping and wind erosion, the organic matter in the cultivated soils was decreased 18 per cent and the nitrogen was decreased 15 per cent. Very little difference occurred in the nitrogen and organic matter content of the cropped and virgin subsurface soils.

The wind tends to change the soil texture through removal of the silt fraction and may deplete the total fertility of the soil by sifting out the lighter and more fertile portion and carrying it away (5). Samples of dust collected in Oklahoma during the dust storms of 1930 contained on the average 62.5 per cent silt and 14.3 per cent sand. The original soil, Richfield silt loam, contained 42 per cent silt and 35.4 per cent sand, whereas the drift soil contained 58.2 per cent sand and only 15 per cent silt.

The dust contained 1.77 times as much combustible matter as the field soil and 1.47 times as much as the drift soil. The total nitrogen content of the dust was 2.15 times that of field soil and 1.88 times that of drift soil. The dust contained 1.95 times as much phosphorus as the field soil and 2.04 times as much as the drift soil, and contained 1.99 times as much base-exchange calcium as the field soil.

Samples of dust laid down on snow and ice in Iowa by a dust storm originating in the Texas-Oklahoma Panhandle early in 1937 were collected and compared with samples taken from a small dune formed by the same wind disturbance at Dalhart, Texas (1). The dust contained roughly 10 times as much organic matter, 9 times as much nitrogen, 19 times as much phosphoric acid, and about 1½ times as much potash as the dune material. Analyses indicated a similar sorting effect with respect to removal of both soil particles and chemical constituents. The unaffected grass-covered soil contained 79.2 per cent coarse materials (total sands)

TABLE IV.—ORGANIC MATTER AND PARTIAL CHEMICAL CONTENT OF SOIL OF UNPLOWED GRASSLAND, DUNE SAND, AND DUST.

Element	Unplowed grassland, near Dalhart, Tex.	Dune sand, Dalhart, Tex.	Dust	
			Hays, Kans.	Clarinda, Ia.
	Per cent	*Per cent*	*Per cent*	*Per cent*
CaO	0.34	0.31	3.15	1.98
K_2O	2.05	1.77	2.46	2.58
P_2O_5	0.04	trace	0.14	0.19
Nitrogen	0.06	0.02	0.20	0.19
Organic matter	1.06	0.33	3.34	3.35

as compared with no sand in the dust, and 19.6 per cent of fine material (silt and clay) as compared with 97 per cent in the dust. The dust contained more than three times as much organic matter and nitrogen, respectively, as the virgin soil; nearly five times as much phosphoric acid; and one and one-fourth times as much potash.

Samples of dust originating in the 1937 Panhandle storm and deposited at Hays, Kansas, and Clarinda, Iowa, were compared with samples of soil of unplowed grassland and with dune sand collected near Dalhart, Texas (1). The results of the analysis of the samples are shown in Table IV.

The data show that the original unplowed soil was much higher in essential plant nutrients and organic matter than the dune sand but much lower in these materials than the dust collected at Hays and Clarinda.

Much fertile material in the soil is lost through erosion. Material eroded from Collington sandy loam in New Jersey from June 12, 1938, to December 31, 1941, contained 4 times as much organic matter, 1.5 times as much phosphorus, 1.4 times as much potassium, and 2.3 times as much calcium as there was in the soil before erosion occurred (13). The loss per acre due to erosion was 1.149 pounds of organic matter, 67 pounds of nitrogen, 154 pounds of P_2O_5, 575 pounds of K_2O, and 141 pounds of CaO. There were more than 3.5 times as many particles averaging less than 50 microns in diameter in the eroded material than in the surface soil from which the material came. The eroded material contained 58 per cent of materials of this size-class compared with slightly less than 16 per cent in the original soil.

The material eroded from Dunmore silt loam cropped to corn was 16 per cent richer in total nitrogen and 11 per cent richer in phosphorus than the original soil (15). Water-soluble phosphorus in water extracts of eroded material from corn land contained six to eight times as much organic phosphorus as was contained in extracts of the parent soil.

A study of 48 depleted soils and the corresponding virgin soils in Michigan showed that the virgin soil had a greater rate of solubility, as measured by the freezing point method with moisture content somewhat above saturation (12). A decrease in rate of solubility is one of the important changes a soil undergoes in passing from a virgin to a more or less depleted condition. This is important since most crop plants feed primarily in the surface or plowed stratum of the soil, and the solubility of subsoils is usually very low compared with that of the surface soils.

The total amount of salts in runoff water from soil erosion plots at Columbia, Missouri, during the year May 1, 1924, to April 30, 1925, ranged from 166.8 pounds per acre for a plot in

wheat and clover to 380.1 pounds per acre for a plot that was spaded four inches deep in the spring and fallowed throughout the season (4). Calcium and sulphur were lost in larger amounts than any of the other elements determined. Although the loss of potassium was rather small, the loss of this element from several plots was much greater than the amount that would ordinarily be applied in commercial fertilizer.

Soil type and cover had a marked effect on both the amounts and concentrations of the solubles lost in runoff at Geneva, New York, during the 13-month period, March 1938 to March 1939, inclusive (2). These effects appeared to be related to variations in soluble concentrations at the soil surface and to the relative rates of infiltration and runoff. The concentrations tended to be higher in the summer months. The proportional losses of the separate soluble constituents in runoff varied considerably. Although losses of solubles reported in runoff were small, an analysis of the factors that produce variability in runoff losses indicates that appreciable losses may be incurred where poor soil management practices are employed.

The annual nitrogen losses from land in Missouri planted to intertilled crops on slopes averaging 200 feet in length have been found to range from 3.8 per cent of the total amount contained in the surface 7 inches of soil for a 2-per-cent slope to 11.1 per cent for a 12-per-cent slope (19). The annual losses on 2-per-cent slopes ranged from 3.8 per cent for slopes averaging 200 feet in length to 10.9 per cent for slopes that averaged 1,200 feet in length. Corresponding losses on a 12-per-cent slope were 11.1 per cent for the 200-foot slope and 18.1 per cent for the 1,200-foot slope.

The loss of nitrogen declined with the introduction of sod-producing crops into the rotation and disappeared altogether on well-sodded meadows or pastures.

Numerous important depletions of organic matter, formerly attributed to oxidation, may have resulted from erosion (16). Depletion of organic matter appeared to be a linear function of erosion. The calculated organic matter percentage of the soil dropped 0.002 per cent at both Clarinda, Iowa, and Bethany, Missouri, for each ton of soil lost by erosion. The amount of or-

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Fig. 4. In extreme cases the body of the soil itself is removed in the erosion process.

Plenty of Moisture, Not Enough Soil Fertility

By Wm. A. Albrecht

Soils Department, University of Missouri, Columbia, Missouri

THE weather records of 1950 for Missouri, and for the rest of the Corn Belt, report the distribution of rainfall during the corn-growing season as very favorable. No period longer than 12 days without significant rainfall during June, July, and August is the record of the weather station at Columbia, Missouri. For June the total rainfall there was 4.87 inches, for July it was 3.04 inches, and for August it was 5.76 inches.

However, in spite of the favorable distribution of rainfall during the summer months, and of the generous total supply of it, the corn crop examined in the fields and in the wagons this fall is disappointing in too many cases for us to be complacent about it. Examination of the corn in many fields in going across not only Missouri, but also Illinois on the east, and Kansas on the west, gives a similar report. Kansas announced "Corn yield per acre best since 1889," to suggest that even with big yields we are just now winning back. Even though this was a "banner year," it is disturbing to many folks still looking for "nice, big ears" when more of them—of less size—per acre and per stalk make bigger production. The ends of the ears are not filled, grain counts per row or per cob reveal as much as 20 per cent of the potential grains unfilled on the small end. The shelling percentage is correspondingly low. Something failed to carry through to finish out the ear. Something was running short, apparently, before the finish.

Such facts suggest that the fertility delivered by the soil was not enough to balance the moisture contributed by rainfall. The latter was equal to more corn but the fertility supplied by the soil was not.

Such a condition in which the tips of the ears fail to fill suggests a potassium deficiency. Treatments of potassium on the soil which gave well-filled ears this year verify that suggestion. Poor tips of ears are common even where ammonium nitrate and sulfate have been used. It is clear, therefore, poor tips are not due to nitrogen shortage. Poor tips are also common this fall on soils that had received generous amounts of phosphorus for some years past.

Nor can these defective ears be ascribed to a calcium shortage in the soil when they were so common on soils properly limed. Whether a magnesium deficiency in the soil and in the plants is responsible is still an open question.

Insufficient potassium supply seems the most likely cause of these defective ear tips, since experiment fields have well-filled ears of corn where potassium was generously applied.

When the surface soil is constantly moist, the roots drink and feed in the topsoil. When the rainfall is less and the surface soil dries out, the roots go more deeply into the soil ahead of the drying effects. Penetration into the heavier clay layers of the soil makes contact with the untapped potassium reserves. Deeper rooting brought about by occasional shortages of rainfall means

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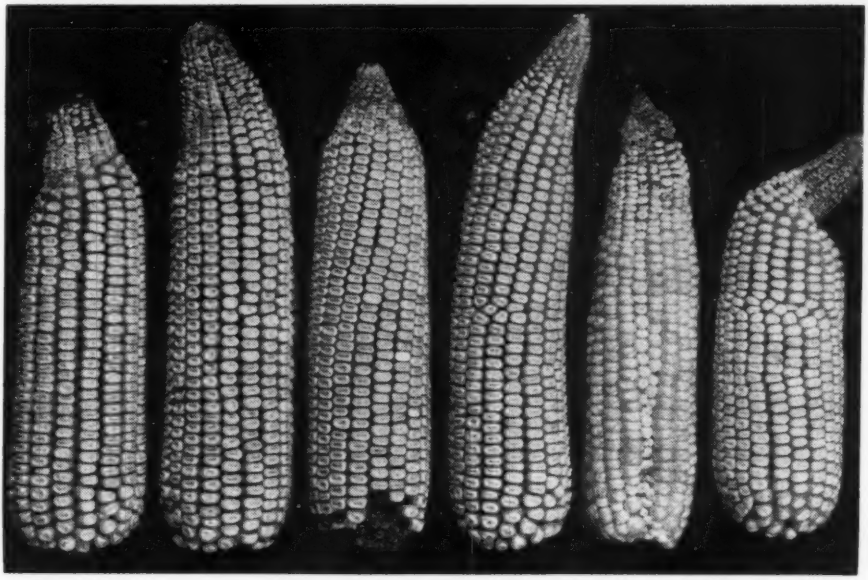

No potassium was applied for the corn above. These poorly filled ears from the 1950 plantings at the Missouri Experiment Station indicate a case of wet-weather deficiency of potassium.

Potassium was applied for the corn below. Both plots had the same frequent, well-distributed rainfall to encourage shallow rooting and shallow feeding by the corn plants. Both plots had phosphorus, nitrogen, and calcium.

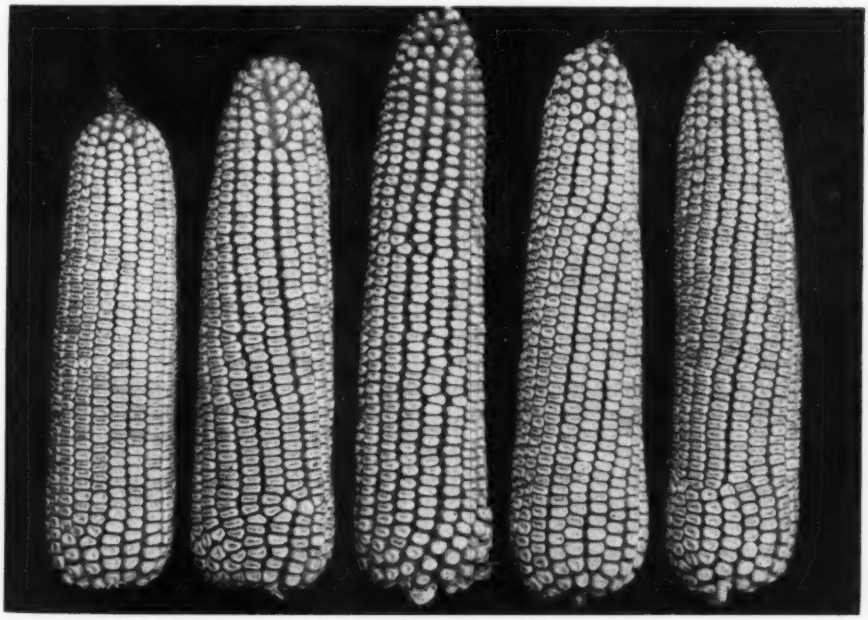

Fig. 1. Hogging-off corn, a practice which is growing in popularity in the Southeast.

The Southeastern Farmer Makes the Change

By George H. King

Georgia Coastal Plain Experiment Station, Tifton, Georgia

FOR the past several years, the agriculture of the Southeast has been in a stage of change, and this transitional period will continue. While this change would possibly have occurred in time, acreage allotments imposed on the major cash crops, cotton, peanuts, and tobacco, have accelerated it. Reduced acreage allotments meant that the farmer had to cast about in other directions to utilize his acres to the best advantage in order to maintain his income level. This is being done in several ways.

First, the farmer is producing with greater efficiency on those acres of allotted crops. Using Georgia as a typical example, we know that the average yield of lint cotton per acre ranges between 200 and 300 pounds. Good farmers following approved practices, involving better varieties, higher fertilization, and more adequate insect control, are producing during normal years 500 pounds or more of lint per acre.

The average yield of peanuts in Georgia is about 700 pounds per acre; yet in 1949, a Sumter County farmer won a peanut contest with a yield of 2,700 pounds per acre, and none of the 12 leading contestants fell below 1,800 pounds. These yields have been brought about by better varieties, more fertilizer, seed treatment, closer spacing, and disease and insect control.

Tobacco yields average about 1,100 pounds per acre, but improved practices in the use of fertilizer and control of insects and diseases enable many

TABLE I. INCREASE IN VALUE OF CORN THROUGH HOGGING-OFF

Corn yield per acre	Protein supplement fed per acre	Live-weight gain per acre	Gross value gain	Cost protein supplement	Returns per bu. corn	Prevailing local corn price
57 bushels	312 lbs.	762 lbs.	$137.16	$12.50	$2.16	$1.00

farmers to produce yields of 1,500 to 2,000 pounds of good quality tobacco per acre.

Second, the farmer is turning into major enterprises some crops, such as corn and sweetpotatoes, heretofore regarded as minor sources of income or as supply crops. Here again, efficiency of production means the difference between success and failure. The Southeastern farmer has made tremendous progress in his ability to produce corn. Georgia in five years has increased its average corn yield from 12 to 18 bushels per acre. The potentialities may be seen, however, when more than 300 Georgia farmers produced over 100 bushels of corn per acre. This increase is due to increased fertilizer, closer spacing, more efficient cultivation, and the use of better varieties and hybrids. Farmers have learned that what they once termed "firing" and attributed to lack of water was really fertilizer deficiency. They have learned that to produce high yields they must have a large number of plants per acre. In 1950, approximately 30 per cent of the Georgia corn crop was in hybrid corn. These farmers have learned that a few quick, shallow cultivations make more corn. Increased yields due to these improved practices are being obtained in all of the Southeastern states.

When yields are increased, corn may change from a "supply" enterprise to a cash enterprise. When used for "hogging-off," its income-producing power may easily be seen. In 1948, at the Georgia Coastal Plain Experiment Station, hogs produced 762 pounds of pork per acre on corn yielding 57 bushels per acre. Even though 312 pounds of protein supplement per acre were fed in addition to the corn, from Table I it may be seen that the value of the corn crop was more than doubled when fed through hogs at the then prevailing (corn-hog) price ratio. In addition, the cost of harvesting and the hazards of storage were eliminated. Also not to be overlooked, is the fact that "hogging-off" corn is a good soil-

TABLE II. FEEDING DEHYDRATED SWEETPOTATOES TO STEERS

	Group 1 Cracked shelled corn	Group 2 Dehydrated sweetpotatoes	Group 3 50% Cracked shelled corn 50% Dehydrated sweetpotatoes
Number of steers	60	60	60
Average initial weight	660 lbs.	660 lbs.	670 lbs.
Average final weight	990 "	962 "	1,031 "
Average daily gain per steer	2.36 "	2.16 "	2.58 "
Total cost per steer and feed	$154.03	$143.74	$161.14
Gross return per steer	$181.07	$162.10	$188.16
Profit per steer	$ 27.04	$ 18.36	$ 27.02

Supplementary feeds: Cottonseed meal, peanut hay, mineral mixture.
(*Bulletin 45, Georgia Coastal Plain Experiment Station*).

improvement practice, while harvesting corn cannot be so regarded.

The average yield of sweetpotatoes in Georgia is about 85 bushels per acre, yet individual farmers are producing from 300 bushels to 600 bushels per acre by using better varieties, closer spacing, and high fertilization. Sweetpotatoes not used for human consumption are left in the field for "hogging-off" or dehydrated and mixed with corn to provide an excellent feed for beef cattle. Table II gives the summary of four years' results in the feeding of dehydrated sweetpotatoes to beef cattle.

It can be seen from the tests that sweetpotatoes may replace as much as 50 per cent of the corn in the ration for fattening steers. Sweetpotatoes used for livestock feed as well as food for table consumption will in many cases graduate from the "supply" category to a major source of cash income on many Georgia farms.

Third, the farmer during this transition period is turning to livestock production. To efficient production of such feed crops as corn, peanuts, sweetpotatoes, and small grains, he must add the establishment and maintenance of good pastures. Pastures are developing by leaps and bounds over the Southeast. Many farmers are meeting the demands of good pastures by preparing the land, planting adapted grasses and clovers, and fertilizing heavily. This change to livestock is possibly the greatest that is taking place in this period of transition. It has been aided by the development of such grasses as coastal Bermuda, the adaptation of the tall fescues to Southern conditions, the development of the Bahia grasses in the coastal areas of the South, the development of reseeding crimson clover under a variety of names, and the refinement of practices with all grasses and clovers in use. For a number of years the Southern farmer was, due to long years of fighting grass, opposed to fertilizing it. This feeling has gone, and the pastures of the South owe much of their new look to adequate fertilization. Yields and food value of the grasses and clovers are increased in a phenomenal way. Coastal Bermuda, for example, when highly fertilized has produced as high as 10 tons of dry hay per acre per year analyzing 14 per cent protein. Through the use of

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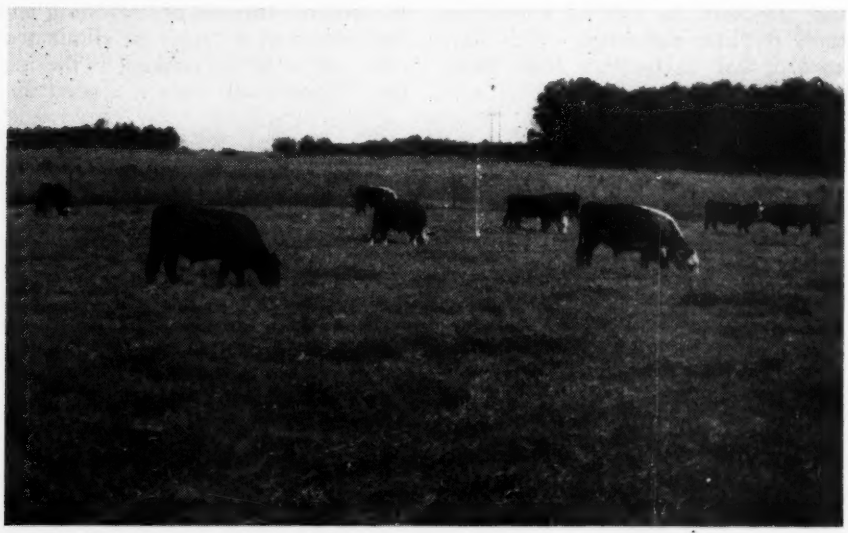


Fig. 2. Twelve steers were maintained on three acres of Coastal Bermuda grass throughout the summer months with a total of 1,707 pounds gain. In addition 1¼ tons of hay per acre were cut.

Sugar Cane and the Soil

By George Samuels[1]

VERY few plants of economic importance have as interesting a soil-plant relationship as sugar cane. Sugar cane, a member of the important family of flowering plants, the Gramineae, is grown for its juices from which sugar is produced. In the leading sugar cane areas of the world (British West Indies, Cuba, Hawaii, India, Java, Louisiana[2], and Puerto Rico), this crop forms a major part of the agricultural economy. Yet, despite years of continuous growth on the same land, sugar cane cannot be considered as a major soil-depleting or deteriorating crop, as are many of our cash crops. The reasons for this are due to certain inherent qualities of the crop itself and the way in which it is normally managed.

Aside from the legumes and pasture grasses, one should not consider most economic agricultural crops as builders of soil organic matter. However, despite the continuous cropping of sugar cane in certain Puerto Rican soils for over 100 years without any green-manure or cover crop, the organic matter content of these soils has shown no evident serious depletion. In fact, increases in the organic matter content of the lower part of the top foot of soil have been shown as a result of deep plowing. This is clearly revealed in Table I where the comparison of a virgin (not cultivated in the last 25 years) and a cultivated sugar cane profile of the same soil type is presented. Except for a decrease in the 0-3 inches due to the disturbance of the accumulation or organic matter in the virgin state, the cultivated sugar cane soils show no decided decrease in organic matter in the 0-6-inch horizon and an increase in organic matter content in the 6-15-inch horizon. The average for the entire 15-inch profile was 2.48 per cent for the virgin and 2.08 per cent for the cultivated, showing only a decrease of 0.40 per cent in the entire 15 inches due to cultivation of sugar cane. Considering the lower volume weight of the surface of the virgin soil, the average loss of organic matter for the 15 inches becomes only 0.25 per cent for the cultivated soil.

Why doesn't the soil organic matter content decrease sharply with continued intensive soil cultivation devoted to a one-crop system? The answer can be realized when we consider the amount

TABLE I.—A COMPARISON OF THE ORGANIC MATTER CONTENT OF A VIRGIN AND CULTIVATED PUERTO RICAN SUGAR CANE SOIL PROFILE, OF THE SOUTH COASTAL AREA.*

Depth inches	Organic matter content, per cent	
	Virgin (Woodland)	Cultivated
0–3	4.28	2.16
3–6	2.95	2.12
6–9	2.12	2.31
9–12	1.82	2.12
12–15	1.22	1.67
0–15 (average)	2.48	2.08

* Data supplied by cooperative research project R.M. #74 (Puerto Rico Agricultural Experiment Station; Soil Conservation Service, and B.P.I.S.A.E., both of the U. S. Department of Agriculture.)

[1] Plant Physiologist, University of Puerto Rico, Agricultural Experiment Station, and Cooperative Soil Specialist with Soil Conservation Service Research and Bureau of Plant Industry, Soils and Agricultural Engineering of U. S. Department of Agriculture on the R. M. Project, "Erosion Control and Stable Crops Production in P. R." of which this is a cooperative paper.

[2] Because the geographic location of Louisiana makes it necessary that sugar cane be managed differently than in tropical areas, the discussion in this article will be limited to the tropical areas.

of organic matter returned to the soil each year by the sugar cane crop. For every 40 tons of cane removed per acre, 10 tons of organic material are left behind in the soil.

An average 40-ton crop of sugar cane stalks leaves behind as trash 20 tons of leafy material consisting partly of dry trash, senescent freshly stripped leaves, and fresh green leaves and tops. Assuming this material contains 50 per cent moisture, we now have 10 tons of dry organic material. This organic material is of best service only when converted to colloidal humus. For 10 tons of organic material with a nitrogen content of 0.6 per cent we will get 2,150 pounds of humus with a C:N ratio of 10:1. Similarly, the roots of the sugar cane crop produce 3,500 pounds of dry material per acre which gives 1,000 pounds of humus. In an acre of soil, 6⅔ inches deep consisting of 2,000,000 pounds of soil, this means a contribution of 0.176 per cent organic matter for every 40 tons of harvested cane.[3]

The contribution of the organic matter to the sugar cane soils has served to keep them in a good physical state despite the continuous cropping. The trash left after the cutting of the sugar cane serves as an effective mulch and ground cover until the crop is tall enough to produce adequate ground coverage. Experiments on 45 per cent slopes in Puerto Rico have shown that trash-covered sugar cane slopes gave a loss of only 0.6 tons of soil per year as compared to 7 tons where the trash was removed by burning.[4]

Of course, sugar cane cannot be grown continuously on the soil without the proper use of fertilizers. Most sugar cane soils are now heavily fertilized. Although sugar cane may contribute to the soil organic matter, it does not add sufficient plant nutrients to the soil. However, let us see just what nutrients are removed from the soil by the sugar cane. In Table II are given representative values of the elements removed by 40 tons of sugar cane.

TABLE II.—POUNDS OF NUTRIENTS REMOVED IN A 40-TON PER ACRE CROP OF UBA SUGAR CANE.*

Part	Plant material pounds	NH^3	P^2O^5	K^2O	CaO	SO^3
Canes	80,000	57.4	20.0	12.0	29.6	32.0
Tops	12,701	33.8	9.9	15.9	8.8	20.6
Dry leaves	4,850	20.8	5.5	8.7	23.6	19.7
Total	97,551	112.0	35.4	36.6	52.0	72.3

* Calculated from information supplied by Dr. J. A. Bonnet, Soils Department, Agricultural Experiment Station of the University of Puerto Rico.

The largest single item removed by the sugar cane is nitrogen. The nitrogen removed by the 40 tons of cane is 57.5 pounds of NH_3, equivalent to 235 pounds of sulfate of ammonia fertilizer. The entire crop removes 113 pounds of NH_3 but 54.6 are returned in the tops and dry leaves. The phosphorus removed by the cane amounts to 20 pounds as P_2O_5 or an amount equal to 100 pounds of 20 per cent superphosphate. The amount of potassium removed as K_2O is 12 pounds, equivalent to 20 pounds of potassium chloride. The potassium value given here, however, is lower than is generally obtained for cane in Puerto Rico under normal fertilization. A value of 48.7 pounds of K_2O [5] or 81 pounds of potassium chloride removed by the 40 tons of cane is more representative. The ratio of NH_3, P_2O_5, and K_2O removed by the cane is approximately 15:5:12 if we use the NH_3 and P_2O_5 values of Table II and the corrected K_2O value. This ratio is quite similar to the

(*Turn to page* 41)

[3] Calculated from data by F. Hardy in Tropical Agriculture, Vol. 21:203-209 (1944).

[4] Data supplied from the Cooperative Research Purnell Project #17 of the Puerto Rico Agricultural Experiment Station and the Soil Conservation Service of the U. S. Department of Agriculture.

[5] Calculated from Van Slyke's values, U. S. Department of Agriculture Yearbook of Agriculture, 1938, p. 399.

PICTORIAL

Looking for—Peace on Earth, Good Will Toward Men.

Solid Contentment

Below. Courtesy WJZ Farm News Program

Winter Odd Jobs

Evergreens—North and South

The Editors Talk

Backward and Forward

As a year ends and a new one dawns, it is well to summarize the old one and very important to look as far as possible into the new one. Hindsight is always easier than foresight. This never was more true than now when the future of all of us is so closely tied in with the uncertainties of the world situation. Yet several factors for American agriculture in 1951 are now apparent.

Turning to a summarization for 1950, there is every indication that the year has been a favorable one for the majority of farmers. At the beginning of the year it was thought that farm income might drop as much as 5 or 10 per cent under 1949. A stiffening of prices the latter part of the year coupled with a high level of production enabled farmers to overcome the reduced income of the earlier months and wind up with receipts that will almost equal those of 1949.

Production expenses increased. This resulted in an unfavorable ratio of expenses to income during the earlier part of the year, so that the farmers' purchasing power dropped. This situation also improved in the later months and as a result the year ends with a ratio of prices received to those paid 5 or 6% above normal.

The favorable agricultural situation that developed during the latter part of the year, together with an increased demand for agricultural products, has resulted in increased land values over many parts of the country. Some of this demand has been from city people who wished to purchase agricultural land as a hedge against inflation. Some of it was due to farmers wishing to expand their production.

The strengthening demand for agricultural products turned the worry over surpluses into concern over building stockpiles to meet a national emergency.

1951

Turning now to a look into 1951, it is believed that most farmers will receive higher incomes despite higher costs for production goods, family living, and taxes. Total farm income for 1951 is estimated at from 10 to 15% higher than in 1950—a record high. With normal weather, a new peak in production is expected. This will be met with a strong consumer demand resulting from full employment at high wages. With this urban income limited in the purchase of durable goods, more of it will be spent upon food and clothing. Military spending will greatly increase as our armed forces are stepped up to the 5 million in uniform expected by the end of 1951. Uncle Sam feeds his services well.

Secretary of Agriculture Charles F. Brannan has called for all-out production with promise of price support where necessary to encourage output. Farmers are being urged to purchase early the supplies which they will need. Particularly is this true for fertilizers, insecticides, and machinery. While supplies are

adequate now, shortages may develop later due to storage and transportation difficulties.

In planning for 1951, the possibility of an acute labor situation must not be overlooked. It is expected that around 225,000 farm boys will be drafted for military service and about an equal number of full-time farm workers will be lured by higher wages to industrial employment in towns and cities. Some of this shortage, as in past emergencies, will be made up by importing foreign workers and seasonal recruiting from urban centers. However, there will be a necessity for more production with less work.

According to Reuben W. Hecht of the Bureau of Agricultural Economics, U. S. Department of Agriculture, the cut in labor used per acre of crops has been due chiefly to increased use of mechanically powered machines. The list of these machines is long. Small grain combines, corn pickers, field forage harvesters for both hay and row crops, mowers and other haying machines, and cultivators and other tillage implements are important items. Greater use of automobiles and motor trucks have reduced time for farm-hauling jobs.

The list of factors that have raised crop yields also is long. Weather has been very influential during recent years, but over the long pull, other factors are more important. These include the use of new hybrids and varieties of crops—of which hybrid corn is an outstanding example—increased application of fertilizers and lime, adoption of soil- and moisture-conserving practices, more effective control of pests and diseases, and irrigation and drainage. In recent years, productivity of labor used in production of livestock products has increased at a rate more nearly in line with the productivity of labor used in crops.

Let us repeat that the look ahead is most important. With the threat of a third world war upon us and with the advantage of a hindsight on 1950, every individual connected with agriculture should bend his brain and back to make the records of 1951 materialize. We can do it and will.

Good Advice

A University of Illinois soils man is strongly urging farmers to order their spring fertilizer supplies now and to apply the plant foods to the soil this winter. He is A. L. Lang, who says there is plenty of fertilizer on hand now and supplies should be adequate if they are evenly distributed. But if most folks wait until next spring to order, supplies are almost sure to tighten up and many men will be disappointed.

Advantages of ordering now are that demand next spring is likely to be unusually heavy and the price is more likely to go up than down. Farmers will also get better quality now and the kind and grade they want. There may be freight car bottlenecks next spring too, since military supplies will move first.

Lang believes the best place to store fertilizers is in the soil. Limestone, rock phosphate, superphosphate, and potash can be put on any time this winter. Nitrogen, of course, must wait until next spring, since it is quickly available and would leach out of the soil during the winter.

Another advantage of winter application is the time and labor saved against the rush of spring work. This may be especially important this year with the expected shortage of farm workers.

Where fertilizer must be stored in buildings, it should be kept dry, up off the floor, and stacked no more than six or eight bags high, Lang advises.

Season Average Prices Received by Farmers for Specified Commodities *

Crop Year	Cotton Cents per lb. Aug.-July	Tobacco Cents per lb.	Potatoes Cents per bu. July-June	Sweet Potatoes Cents per bu. July-June	Corn Cents per bu. Oct.-Sept.	Wheat Cents per bu. July-June	Hay [1] Dollars per ton July-June	Cottonseed Dollars per ton July-June	Truck Crops ....
Av. Aug. 1909–July 1914....	12.4	10.0	69.7	87.8	64.2	88.4	11.87	22.55	....
1925.....	19.6	16.8	170.5	165.1	69.9	143.7	12.77	31.59	....
1926.....	12.5	17.9	131.4	117.4	74.5	121.7	13.24	22.04	....
1927.....	20.2	20.7	101.9	109.0	85.0	119.0	10.29	34.83	....
1928.....	18.0	20.0	53.2	118.0	84.0	99.8	11.22	34.17	....
1929.....	16.8	18.3	131.6	117.1	79.9	103.6	10.90	30.92	....
1930.....	9.5	12.8	91.2	108.1	59.8	67.1	11.06	22.04	....
1931.....	5.7	8.2	46.0	72.6	32.0	39.0	8.69	8.97	....
1932.....	6.5	10.5	38.0	54.2	31.9	38.2	6.20	10.33	....
1933.....	10.2	13.0	82.4	69.4	52.2	74.4	8.09	12.88	....
1934.....	12.4	21.3	44.6	79.8	81.5	84.8	13.20	33.00	....
1935.....	11.1	18.4	59.3	70.3	65.5	83.2	7.52	30.54	....
1936.....	12.4	23.6	114.2	92.9	104.4	102.5	11.20	33.36	....
1937.....	8.4	20.4	52.9	78.0	51.8	96.2	8.74	19.51	....
1938.....	8.6	19.6	55.7	69.8	48.6	56.2	6.78	21.79	....
1939.....	9.1	15.4	69.7	73.4	56.8	69.1	7.94	21.17	....
1940.....	9.9	16.0	54.1	85.4	61.8	68.2	7.59	21.73	....
1941.....	17.0	26.4	80.8	92.2	75.1	94.4	9.70	47.65	....
1942.....	19.0	36.9	117.0	118.0	91.7	110.0	10.80	45.61	....
1943.....	19.9	40.5	131.0	206.0	112.0	136.0	14.80	52.10	....
1944.....	20.7	42.0	150.0	190.0	109.0	141.0	16.50	52.70	....
1945.....	22.5	36.6	143.0	204.0	127.0	150.0	15.10	51.10	....
1946.....	32.6	38.2	124.0	218.0	156.0	191.0	16.70	72.00	....
1947.....	31.9	38.0	162.0	217.0	216.0	229.0	17.60	85.90	....
1948.....	30.4	48.2	155.0	222.0	129.0	200.0	18.45	67.20	....
1949.....	28.6	46.3	128.0	214.0	119.0	186.0	16.55	43.40	....
December....	26.50	45.4	131.0	202.0	113.0	193.0	17.15	43.30	....
1950									
January.....	26.47	39.7	136.0	215.0	115.0	192.0	17.15	43.60	....
February....	27.50	34.1	133.0	221.0	116.0	193.0	16.75	43.60	....
March.....	28.05	32.0	132.0	222.0	119.0	198.0	16.45	43.00	....
April.....	28.74	....	134.0	228.0	126.0	201.0	16.65	44.40	....
May.....	29.24	48.5	128.0	228.0	134.0	204.0	17.25	45.20	....
June.....	29.91	49.7	127.0	211.0	136.0	193.0	16.05	46.20	....
July.....	33.05	45.5	127.0	208.0	144.0	199.0	15.15	52.00	....
August.....	36.95	53.1	122.0	218.0	144.0	197.0	15.45	70.90	....
September...	39.98	55.4	105.0	192.0	144.0	194.0	15.55	78.80	....
October.....	38.90	55.1	85.8	154.0	137.0	191.0	15.85	81.50	....
November....	41.13	52.5	87.8	148.0	137.0	194.0	16.45	98.40	....

Index Numbers (Aug. 1909—July 1914 = 100)

1925.....	158	168	245	188	109	163	108	140	143
1926.....	101	179	189	134	116	138	112	98	139
1927.....	163	207	146	124	132	135	87	154	127
1928.....	145	200	76	134	131	113	95	152	154
1929.....	135	183	189	133	124	117	92	137	137
1930.....	77	128	131	123	93	76	93	98	129
1931.....	46	82	66	83	50	44	73	40	115
1932.....	52	105	55	62	50	43	52	46	102
1933.....	82	130	118	79	81	84	68	57	91
1934.....	100	213	64	91	127	96	111	146	95
1935.....	90	184	85	80	102	94	63	135	119
1936.....	100	236	164	106	163	116	94	148	104
1937.....	68	204	76	89	81	109	74	87	110
1938.....	69	196	80	79	76	64	57	97	88
1939.....	73	154	100	84	88	78	67	94	91
1940.....	80	160	78	97	96	77	64	96	111
1941.....	137	264	116	105	117	107	82	211	129
1942.....	153	369	168	134	143	124	91	202	163
1943.....	160	405	188	235	174	154	125	231	245
1944.....	167	420	214	216	170	160	139	234	212
1945.....	181	366	205	232	198	170	127	227	207
1946.....	263	382	178	248	212	209	141	319	182
1947.....	257	380	232	248	336	259	148	381	226
1948.....	245	482	222	253	201	226	155	298	214
1949.....	231	463	184	244	210	210	139	192	201
December....	214	454	188	230	176	218	144	192	196
1950									
January.....	213	397	195	245	179	217	144	193	261
February....	222	341	191	252	181	218	141	193	203
March.....	226	320	189	253	185	224	139	191	168
April.....	232	....	192	260	196	227	140	197	205
May.....	236	485	184	260	209	231	145	200	178
June.....	241	497	182	240	212	218	135	205	182
July.....	267	455	182	237	224	225	128	231	200
August.....	298	531	175	248	224	223	130	314	164
September...	322	554	151	219	224	219	131	349	126
October.....	314	551	123	175	213	216	134	361	138
November....	332	525	126	169	213	219	139	436	188

Wholesale Prices of Ammoniates

	Nitrate of soda bulk per unit N	Sulphate of ammonia bulk per unit N	Cottonseed meal S. E. Mills per unit N	Fish scrap, dried 11–12% ammonia, 15% bone phosphate, f.o.b. factory bulk per unit N	Tankage 11% ammonia, 15% bone phosphate, f.o.b. Chicago, bulk, per Unit N	High grade ground blood, 16–17% ammonia, Chicago, bulk, per Unit N
1910–14	$2.68	$2.85	$3.50	$3.53	$3.37	$3.52
1925	3.11	2.47	5.41	5.34	3.97	4.75
1926	3.06	2.41	4.40	4.95	4.36	4.90
1927	3.01	2.26	5.07	5.87	4.32	5.70
1928	2.67	2.30	7.06	6.63	4.92	6.00
1929	2.57	2.04	5.64	5.00	4.61	5.72
1930	2.47	1.81	4.78	4.96	3.79	4.58
1931	2.34	1.46	3.10	3.95	2.11	2.46
1932	1.87	1.04	2.18	2.18	1.21	1.36
1933	1.52	1.12	2.95	2.86	2.06	2.46
1934	1.52	1.20	4.46	3.15	2.67	3.27
1935	1.47	1.15	4.59	3.10	3.06	3.65
1936	1.53	1.23	4.17	3.42	3.58	4.25
1937	1.63	1.32	4.91	4.66	4.04	4.80
1938	1.69	1.38	3.69	3.76	3.15	3.53
1939	1.69	1.35	4.02	4.41	3.87	3.90
1940	1.69	1.36	4.64	4.36	3.33	3.39
1941	1.69	1.41	5.50	5.32	3.76	4.43
1942	1.74	1.41	6.11	5.77	5.04	6.76
1943	1.75	1.42	6.30	5.77	4.86	6.62
1944	1.75	1.42	7.68	5.77	4.86	6.71
1945	1.75	1.42	7.81	5.77	4.86	6.71
1946	1.97	1.44	11.04	7.38	6.60	9.33
1947	2.50	1.60	12.72	10.66	12.63	10.46
1948	2.86	2.03	12.94	10.59	10.84	9.85
1949	3.15	2.29	10.11	13.18	10.73	10.62
December	3.00	2.32	12.94	13.88	9.87	9.94
1950						
January	3.00	2.32	10.27	13.79	10.26	10.08
February	3.00	2.32	9.37	13.45	8.96	8.96
March	3.00	2.32	9.70	13.01	10.17	9.34
April	3.00	2.32	10.34	12.58	10.39	8.19
May	3.00	2.05	10.74	11.97	10.14	7.59
June	3.00	1.71	10.55	10.79	9.41	7.36
July	3.00	1.71	11.53	10.71	9.35	8.74
August	3.00	1.71	11.44	11.06	10.62	9.87
September	3.00	1.71	11.44	10.85	10.85	10.32
October	3.00	1.71	11.86	10.63	10.62	10.32
November	3.00	1.68	11.96	10.63	10.85	10.62
Index Numbers (1910-14 = 100)						
1925	115	87	155	151	117	135
1926	113	84	126	140	129	139
1927	112	79	145	166	128	162
1928	100	81	202	188	146	170
1929	96	72	161	142	137	162
1930	92	64	137	141	112	130
1931	88	51	89	112	63	70
1932	71	36	62	62	36	39
1933	59	39	84	81	97	71
1934	59	42	127	89	79	93
1935	57	40	131	88	91	104
1936	59	43	119	97	106	131
1937	61	46	140	132	120	122
1938	63	48	105	106	93	100
1939	63	47	115	125	115	111
1940	63	48	133	124	99	96
1941	63	49	157	151	112	126
1942	65	49	175	163	150	192
1943	65	50	180	163	144	189
1944	65	50	219	163	144	191
1945	65	50	223	163	144	191
1946	74	51	315	209	196	265
1947	93	56	363	302	374	297
1948	107	71	370	300	322	280
1949	117	80	289	373	318	302
December	112	81	311	393	293	282
1950						
January	112	81	293	391	304	286
February	112	81	268	381	266	255
March	112	81	277	369	302	265
April	112	81	295	356	308	233
May	112	72	307	339	301	216
June	112	60	301	306	279	209
July	112	60	329	303	277	248
August	112	60	327	313	315	280
September	112	60	327	307	322	293
October	112	60	339	301	315	293
November	112	59	342	301	322	302

Wholesale Prices of Phosphates and Potash * *

	Superphosphate, Baltimore, per unit	Florida land pebble, 68% f.o.b. mines, bulk, per ton	Tennessee phosphate rock, 75% f.o.b. mines, bulk, per ton	Muriate of potash bulk, per unit, c.i.f. Atlantic and Gulf ports[2]	Sulphate of potash in bags, per unit, c.i.f. Atlantic and Gulf ports[2]	Sulphate of potash magnesia, per ton, c.i.f. Atlantic and Gulf ports[2]	Manure salts bulk, per unit, c.i.f. Atlantic and Gulf ports[2]
1910–14	$0.536	$3.61	$4.88	$0.714	$0.953	$24.18	$0.657
1925	.600	2.44	6.16	.584	.860	23.72	.483
1926	.598	3.20	5.57	.596	.854	23.58	.537
1927	.525	3.09	5.50	.646	.924	25.55	.586
1928	.580	3.12	5.50	.669	.957	26.46	.607
1929	.609	3.18	5.50	.672	.962	26.59	.610
1930	.542	3.18	5.50	.681	.973	26.92	.618
1931	.485	3.18	5.50	.681	.973	26.92	.618
1932	.458	3.18	5.50	.681	.963	26.90	.618
1933	.434	3.11	5.50	.662	.864	25.10	.601
1934	.487	3.14	5.67	.486	.751	22.49	.483
1935	.492	3.30	5.69	.415	.684	21.44	.444
1936	.476	1.85	5.50	.464	.708	22.94	.505
1937	.510	1.85	5.50	.508	.757	24.70	.556
1938	.492	1.85	5.50	.523	.774	15.17	.572
1939	.478	1.90	5.50	.521	.751	24.52	.570
1940	.516	1.90	5.50	.517	.730	24.75	.573
1941	.547	1.94	5.64	.522	.780	25.55	.367
1942	.600	2.13	6.29	.522	.810	25.74	.205
1943	.631	2.00	5.93	.522	.786	25.35	.195
1944	.645	2.10	6.10	.522	.777	25.35	.195
1945	.650	2.20	6.23	.522	.777	25.35	.195
1946	.671	2.41	6.50	.508	.769	24.70	.190
1947	.746	3.05	6.60	.432	.706	18.93	.195
1948	.764	4.27	6.60	.397	.681	14.14	.195
1949	.770	3.88	6.22	.397	.703	14.14	.195
December	.770	3.76	5.47	.375	.720	14.50	.200
1950							
January	.762	3.76	5.47	.375	.720	14.50	.200
February	.760	3.76	5.47	.375	.720	14.50	.200
March	.760	3.76	5.47	.375	.720	14.50	.200
April	.760	3.76	5.47	.375	.720	14.50	.200
May	.760	3.76	5.47	.375	.720	14.50	.200
June	.760	3.76	5.47	.336	.647	12.77	.176
July	.760	3.76	5.47	.368	.704	13.98	.193
August	.760	3.76	5.47	.368	.704	13.98	.193
September	.760	3.75	5.47	.368	.704	13.98	.193
October	.760	3.73	5.47	.386	.704	13.98	.193
November	.760	3.73	5.47	.386	.732	14.72	.193
Index Numbers (1910-14 = 100)							
1925	110	68	126	82	90	98	74
1926	112	88	114	83	90	98	82
1927	100	86	113	90	97	106	89
1928	108	86	113	94	100	109	92
1929	114	88	113	94	101	110	93
1930	101	88	113	95	102	111	94
1931	90	88	113	95	102	111	94
1932	85	88	113	95	101	111	94
1933	81	86	113	93	91	104	91
1934	91	87	110	68	79	93	74
1935	92	91	117	58	72	89	68
1936	89	51	113	65	74	95	77
1937	95	51	113	71	79	102	85
1938	92	51	113	73	81	104	87
1939	89	53	113	73	79	101	87
1940	96	53	113	72	77	102	87
1941	102	54	110	73	82	106	87
1942	112	59	129	73	85	106	84
1943	117	55	121	73	82	105	83
1944	120	58	125	73	82	105	83
1945	121	61	128	73	82	105	83
1946	125	67	133	71	81	102	82
1947	139	84	135	70	74	78	83
1948	143	118	135	67	72	58	83
1949	144	108	128	67	74	58	83
December	144	104	112	68	76	60	83
1950							
January	142	104	112	68	76	60	83
February	142	104	112	68	76	60	83
March	142	104	112	68	76	60	83
April	142	104	112	68	76	60	83
May	142	104	112	68	76	60	83
June	142	104	112	63	68	53	80
July	142	104	112	67	74	58	82
August	142	104	112	67	74	58	82
September	142	104	112	67	74	58	82
October	142	103	112	70	74	58	82
November	142	103	112	70	77	61	82

Combined Index Numbers of Prices of Fertilizer Materials, Farm Products and All Commodities

	Farm prices*	Prices paid by farmers for commodities bought*	Wholesale prices of all commodities†	Fertilizer material‡	Chemical ammoniates	Organic ammoniates	Superphosphate	Potash**
1925	156	153	151	112	100	131	109	80
1926	146	150	146	119	94	135	112	86
1927	141	148	139	116	89	150	100	94
1928	149	152	141	121	87	177	108	97
1929	148	150	139	114	79	146	114	97
1930	125	140	126	105	72	131	101	99
1931	87	119	107	83	62	83	90	99
1932	65	102	95	71	46	48	85	99
1933	70	104	96	70	45	71	81	95
1934	90	118	109	72	47	90	91	72
1935	109	123	117	70	45	97	92	63
1936	114	123	118	73	47	107	89	69
1937	122	130	126	81	50	129	95	75
1938	97	122	115	78	52	101	92	77
1939	95	121	112	79	51	119	89	77
1940	100	122	115	80	52	114	96	77
1941	123	130	127	86	56	130	102	77
1942	158	149	144	93	57	161	112	77
1943	192	165	151	94	57	160	117	77
1944	196	174	152	96	57	174	120	76
1945	206	180	154	97	57	175	121	76
1946	234	197	177	107	62	240	125	75
1947	275	231	222	130	74	362	139	72
1948	285	250	241	134	89	314	143	70
1949	249	240	226	137	99	319	144	70
December	233	237	221	136	96	317	144	72
1950								
January	235	238	221	135	96	316	142	72
February	237	237	223	132	96	286	142	72
March	237	239	223	134	96	305	142	72
April	241	240	223	135	96	313	142	72
May	247	244	228	132	91	311	142	72
June	247	245	230	126	85	293	142	66
July	263	247	238	128	85	301	142	70
August	267	248	243	131	85	321	142	70
September	272	252	247	131	85	324	142	70
October	268	253	247	131	85	323	142	73
November	276	255	250	132	85	328	142	74

* U. S. D. A. figures, revised January 1950. Beginning January 1946 farm prices and index numbers of specific farm products revised from a calendar year to a crop-year basis. Truck crops index adjusted to the 1924 level of the all-commodity index.

† Department of Labor index converted to 1910-14 base.

‡ The Index numbers of prices of fertilizer materials are based on original study made by the Department of Agricultural Economics and Farm Management, Cornell University, Ithaca, New York. These indexes are complete since 1897. The series was revised and reweighted as of March 1940 and November 1942.

[1] Beginning July 1949, baled hay prices reduced by $4.75 a ton to be comparable to loose hay prices previously quoted.

[2] All potash salts now quoted F.O.B. mines only: manure salts since June 1941, other carriers since June 1947.

**** The weighted average of prices actually paid for potash is lower than the annual average because since 1926 over 90% of the potash used in agriculture has been contracted for during the discount period. Since 1937, the maximum discount has been 12%. Applied to muriate of potash, a price slightly above $.471 per unit K_2O thus more nearly approximates the annual average than do prices based on arithmetical averages of monthly quotations.**

REVIEWS

This section contains a short review of some of the most practical and important bulletins, and lists all recent publications of the United States Department of Agriculture, the State Experiment Stations, and Canada, relating to Fertilizers, Soils, Crops, and Economics. A file of this department of BETTER CROPS WITH PLANT FOOD would provide a complete index covering all publications from these sources on the particular subjects named.

Fertilizers

"Fertilizer Sales, By Grades 1949-1950 Season," Ala. Dept. of Agr. & Ind., Montgomery, Ala., Sept. 11, 1950.

"Inspection of Commercial Fertilizers," Agr. Exp. Sta., Purdue Univ., Lafayette, Ind., Cir. 361, Apr. 1950, F. W. Quackenbush, O. W. Ford, A. S. Carter, R. Serro, B. Tripp, R. R. Hagelberg, M. F. Bodkin, C. M. Cohee, S. H. Hall, H. C. Kennedy, and F. H. Wilcox.

"Soil Fertility Practices for Cotton Production in the Yazoo-Mississippi Delta," Agr. Exp. Sta., Miss. State College, State College, Miss., Bul. 473, May 1950, P. H. Grissom.

"Effects of Fertilizers Upon the Yield, Grade and Marketability of Cabbage," Agr. Exp. Stat., Texas A&M College System, College Station, Tex., P.R. 1255, June 20, 1950, C. C. Burleson, J. S. Morris, P. W. Leeper, W. R. Cowley, and G. Otey.

"Know Your Fertilizers," Ext. Serv., State College of Wash., Pullman, Wash., Ext. Cir. No. 160, Oct. 1950.

Soils

"Physical Land Conditions in the Fredonia Soil Conservation District Arizona," Agr. Exp. Sta., Univ. of Ariz., Tucson, Ariz., Bul. 231, July 1950, M. S. James, R. D. Headley, H. V. Smith, and W. G. Harper.

"Crop Rotation and Fertilization for Soil Improvement," Agr. Exp. Sta., Univ. of Ark., Fayetteville, Ark., Bul. 497, June 1950, R. P. Bartholomew.

"Does Your Soil Need Lime?" Soils Dept., Ontario Agr. College, Guelph, Ontario, Canada, Bul. 477, June 1950.

"Soil Survey Report of Southeastern New Brunswick," Exp. Farms Serv., Dominion Dept. of Agr. in Co-op. with the New Brunswick Dept. of Agr., 3rd Rpt. of the New Brunswick Soil Survey, Fredericton, N. B., H. Aalund and R. E. Wicklund.

"Soil Survey of Soulanges and Vaudreuil Counties in the Province of Quebec," Exp. Farms Serv., Canada Dept. of Agr. in Co-op. with the Quebec Dept. of Agr. and Macdonald College, McGill Univ., P. Lajoie and P. Stobbe.

"The Morgan Soil Testing System," Agr. Exp. Sta., New Haven, Conn., Bul. 541, May 1950, H. A. Lunt, C. L. W. Swanson, and H. G. M. Jacobson.

"Characteristics of Saline and Alkaline Soils in the Emmett Valley Area, Idaho," Agr. Exp. Sta., Univ. of Idaho, Moscow, Idaho, Res. Bul. 17, May 1950, M. Fireman, C. A. Mogen, and G. O. Baker.

"Soil Building With Legumes," Agr. Exp. Sta., Univ. of Ill., Urbana, Ill., Bul. 539, June 1950, H. J. Snider.

"Costs and Benefits from Soil Conservation in Northeastern Illinois," Agr. Exp. Sta., Univ. of Ill., Urbana, Ill., Bul. 540, June 1950, E. L. Sauer, J. L. McGurk, and L. J. Norton.

"The Effect of Summer Fallow on Wheat Yields in Western Kansas," Agr. Exp. Sta., Manhattan, Kans., Agr. Econ. Rpt. No. 42, May 1950, E. N. Castle.

"Leeching and Pre-emergence Irrigation for Sugar Beets on Saline Soils," Agr. Exp. Sta., State College of Wash., Pullman, Wash., Bul. 519, Oct. 1950, W. R. Heald, C. D. Moodie, and R. W. Leamer.

"Conquest of the Land Through Seven Thousand Years," USDA, Wash., D. C., S.C.S. MP-32, W. C. Lowdermilk.

Crops

"Sorghum Yield Tests 1937-49," Agr. Exp. Sta., Univ. of Ark., Fayetteville, Ark., Rpt. Series 17, May 1950, W. J. Wiser.

"Philip and Mabel Two New Nectarines for California," Agr. Exp. Sta., Univ. of Calif., Berkeley, Calif., Bul. 717, Aug. 1950, C. O. Hesse.

"Seventy-Fourth Annual Report of the Ontario Agricultural College and Experimental Farm 1949," Ontario Dept. of Agr., Guelph, Ontario, Canada.

"Ladino Clover," Canada Dept. of Agr., Exp. Sta., Lennoxville, Que., Canada, Pub. 845, Cir. 189, July 1950, Paul Gervais.

"The Home Fruit Garden," Agr. Ext. Serv., Univ. of Conn., Storrs, Conn., Bul. 354, May 1950, A. C. Bobb.

"Corn Production in North Georgia," Agr. Exp. Sta., Experiment, Ga., Bul. 264, June 1950, O. L. Brooks.

"Defoliate for Better Cotton in Georgia,"

Ga. Coastal Plain Exp. Sta., Tifton, Ga., Cir. 16, May 1950, S. A. Parham and J. H. Turner, Jr.

"Progress in Solving Farm Problems of Illinois Report for 1947-1948," Agr. Exp. Sta., Univ. of Ill., Urbana, Ill.

"Planning and Planting the Apple Orchard," Agr. Exp. Sta., Purdue Univ., Lafayette, Ind., Sta. Cir. 350, June 1950, C. L. Burkholder and R. L. Klackle.

"Growing an Orchard in Kansas," Agr. Exp. Sta., Kans. State College, Manhattan, Kans., Bul. 337, Feb. 1950, R. J. Barnett.

"Sweetpotatoes in Kansas," Agr. Exp. Sta., Kans. State College, Manhattan, Kans., Bul. 341, Mar. 1950, O. H. Elmer.

"Louisiana Corn," Agr. Ext. Serv., La. State Univ. and A&M College, Baton Rouge, La., Agr. Ext. Pub. 1042, Mar. 1950, R. A. Wasson and A. G. Killgore.

"Louisiana Cabbage," Agr. Ext. Serv., La. State. Univ. and A&M College, Baton Rouge, La., Agr. Ext. Pub. 1043, Apr. 1950, J. A. Cox, J. Montelaro, A. Moreau, and D. Spurlock.

"Research Leads the Way to Agricultural Progress," Agr. Exp. Sta., Univ. of Md., College Park, Md., 62nd A.R., 1948-1949, Bul. A53.

"Grasses and Legumes on Michigan Farms," Agr. Exp. Sta., Mich. State College, East Lansing, Mich., Cir. Bul. 217, June 1950, E. B. Hill, C. M. Harrison, J. G. Hays, and staff members of Mich. State College.

"Fifty-Sixth Annual Report, Agricultural Experiment Station, University of Minnesota, July 1, 1948 to June 30, 1949," University Farm, St. Paul, Minn., May 1950.

"Pastures for Mississippi," Agr. Exp. Sta., Miss. State College, State College, Miss., Cir. 151, Feb. 1950, H. W. Bennett.

"Wabash Soybeans for Missouri," Agr. Exp. Sta., Univ. of Mo., Columbia, Mo., Cir. 344, Mar. 1950, C. V. Feaster.

"Grape Growing in Missouri," Agr. Exp. Sta., Univ. of Mo., Columbia, Mo., Cir. 346, Mar. 1950, T. J. Talbert.

"Sudan Grass for Pasture," Cornell Univ., Ithaca, N. Y., Cornell Ext. Bul. 798, May 1950, E. Van Alstine and H. A. MacDonald.

"A Year of Decision," Agr. Ext. Serv., State College, Raleigh, N. C., A.R. 1949.

"Cotton Growing in Southeastern Oklahoma," Agr. Exp. Sta., Okla. A&M College, Stillwater, Okla., Bul. B-358, Sept. 1950, W. F. Lagrone.

"Windbreaks for Eastern Oregon," Fed. Coop. Ext. Serv., Oreg. State College, Corvallis, Oreg., Ext. Cir. 538, May 1950.

"Science for the Farmer," Agr. Exp. Sta., Pa. State College, State College, Pa., 63rd A.R., Bul. 529, July 1950.

"Norghum Sorghum Culture," Agr. Ext. Serv., S. D. State College, Brookings, S. D., Ext. Leaf. 127, Apr. 1950, U. J. Norgaard, E. E. Sanderson, and R. A. Cline.

"Alfalfa Silage," Agr. Ext. Serv., S. D. State College, Brookings, S. D., Ext. Leaf. 130, June 1950, R. A. Cave and E. Bartle.

"Crops for Summer Seeding in South Dakota," Agr. Ext. Serv., S. D. State College, Brookings, S. D., Ext. Leaf. 128, May 1950, U. J. Norgaard.

"Denton Sorghum Variety Tests, 1944-49," P.R. 1242, Apr. 27, 1950, J. H. Gardenhire and D. I. Dudley; "Sugar Beet Variety and Strain Tests in the Lower Rio Grande Valley," P.R. 1243, Apr. 27, 1950, C. A. Burleson, J. S. Morris, and W. R. Cowley; "Denton Corn Performance Tests, 1945-49," P.R. 1244, May 2, 1950, J. H. Gardenhire and D. I. Dudley; Agr. Exp. Sta., Texas A&M College, College Station, Texas.

"Warm Season Grasses for North-Central Texas," Misc. Pub. 52, May 22, 1950, D. I. Dudley; "Cool Season Grasses for North-Central Texas," Misc. Pub. 53, May 22, 1950, D. I. Dudley; "Some Historical Highlights of the Texas Agricultural Experiment Station," Misc. Pub. 57, June 15, 1950, Tad Moses; Agr. Exp. Sta., Texas A&M College, College Station, Tex.

"Vamorr 48 and 50," Agr. Exp. Sta., Va. Poly. Inst., Blacksburg, Va., Bul. 427, Dec. 1949, R. G. Henderson.

"Strawberry Growing in Washington," Ext. Serv., State College of Wash., Pullman, Wash., Ext. Bul. 246, Sept. 1950, J. C. Snyder.

"Forest Plantations in the Lake States," USDA, Wash., D. C., Tech. Bul. 1010, Aug. 1950, P. O. Rudolf.

Economics

"Desert Grapefruit Goes to Market," Agr. Exp. Sta., Univ. of Ariz., Tucson, Ariz., July 1950, R. E. Seltzer.

"Trends and Outlook in the California Grape Industries," Agr. Exp. Sta., Univ. of Calif., Berkeley, Calif., Cir. 397, Aug. 1950, G. L. Mehren and S. W. Shear.

"Ohio Agricultural Statistics 1942-1949," Agr. Exp. Sta., Wooster, Ohio, Bul. 691, Apr. 1950, G. S. Ray, E. E. Houghton, and J. R. Kendall.

"Ohio Agricultural Statistics 1947 and 1948," Agr. Exp. Sta., Wooster, Ohio, Bul. 692, May 1950, G. S. Ray, E. E. Houghton, H. M. Clevenger, and J. R. Kendall.

"Cost of Producing Apples and Pears in the Hood River Valley, Oregon," Agr. Exp. Sta., Oreg. State College, Corvallis, Oreg., P.R. III, Cir. of Inf. 486, June 1950, G. W. Kuhlman and A. E. Irish.

"Farming in the 1950's," Agr. Ext. Serv., S. D. State College, Brookings, S. D., Ext. Leaf. 124, Jan. 1950.

"Cotton Production Practices in Type-of-Farming Area 3, Southwestern Tennessee, 1947," Rural Res. Series Monog. 257, June 21, 1950, S. W. Atkins, R. B. Hughes, Jr., and W. E. Goble; "Farm Adjustments Related to Changes in Farm Returns East Tennessee 1937 to 1948," Rural Res. Series Monog. 261, June 28, 1950, W. P. Ranney; Agr. Exp. Sta., Univ. of Tenn., Knoxville, Tenn.

"Cotton Production Practices in the Black Prairie Area, 1947," Agr. Exp. Sta., College Station, Texas, Misc. Pub. 39, Apr. 1950, Q. M. Morgan, R. B. Glasgow, and R. H. Rogers.

"Trends in Agricultural Production, Costs, and Returns in Utah," Agr. Exp. Sta., Utah State Agr. College, Logan, Utah, Sp. Rpt. 3, Sept. 1950, W. P. Thomas, G. T. Blanch, D. A. Broadbent, E. M. Morrison, R. H. Anderson, and E. W. Lamborn.

"Keeping Up On the Farm Outlook," Agr. Ext. Serv., State College of Wash., Pullman, Wash., Ext. Cir. 162, Sept. 30, 1950, K. Hobson.

"Wisconsin Cranberry Production and Marketing," Wis. State Dept. of Agr., Madison, Wis., Bul. 299, Jan.-Feb., 1950, C. W. Estes and W. W. Morris.

"Teamwork in World Agriculture," USDA, Wash., D. C., Agr. Inf. Bul. 21, 1950.

Know Your Soil: VI. Elkton Sandy Loam

By J. B. Hester

Department of Agricultural Research, Campbell Soup Co., Riverton, New Jersey

THE recent storm that occurred in the Northeast has emphasized forcefully the importance of soil conditions, particularly in regard to the ability of magnificent trees to withstand heavy wind storms.

The Elkton sandy loam belongs to a group of soils that are imperfectly drained. They are not so poorly drained, however, that short-season crops will not produce satisfactorily on odd dry years. When the rainfall is poorly distributed or concentrated during the harvesting season, crops often fail.

This soil does not belong to the poorly drained soils in which organic matter accumulates and makes the

Fig. 1. Results of imperfect drainage conditions during heavy rainfall.

Courtesy E. W. Hobart

Fig. 2. Uprooted tree showing shallow root system developed on imperfectly drained soil.

soil black. It belongs to the group of soils wherein the surface soil is gray to whitish gray in color. Immediately below the surface soil appears a mottled white, light gray, and rustic brown condition. This mottling is indicative of imperfect drainage which results in producing conditions favorable to certain organisms capable of living where free oxygen is limited. This is the reason for the development of the mottled condition.

A typical Elkton sandy loam analyzes pH 4.9, 575 pounds of replaceable calcium, 206 pounds of replaceable magnesium, and 94 pounds of potassium oxide by the ammonium acetate method. It analyzes less than a pound of phosphorus per acre and very high in soluble aluminum, iron, and particularly manganese by the sodium acetate method. The organic matter analyzes 2.1 per cent. These analyses, of course, show the great need for lime; and because of the low calcium content, the soil has a tendency to become compacted and resistant to penetration by water. It is often spoken of as a droughty soil even though it is poorly drained and soggy most of the year.

Figure 1 shows the results of excessive rainfall on the growth of tomatoes on an Elkton sandy loam. Tomatoes and other vegetable crops can withstand poorly drained conditions and excessively hot weather for not more than 24 hours.

The Elkton sandy loam, because of its poor drainage and sub-oxidation condition, has a very strong affinity for phosphates. The phosphates applied to this soil are readily precipitated in the form of ferrous compounds. Work [1] done at the Virginia Truck Experiment Station showed that ferrous phosphate

[1] Hester, J. B., Blume, J. M., and Shelton, F. A. 1937. Rapid chemical tests for Coastal Plain soils. Bul. 95. Va. Truck Exp. Sta.

was practically unavailable to most crops. Because of the fact that the organic matter content is low on this soil and the aerobic decomposition of the organic matter is slow, phosphates are the first limiting factor. In the lower depths of this soil these conditions become increasingly worse. Nitrate formation is very low particularly during the winter and early spring. Even though the soil is well supplied with total potash, the availability is low because of the lack of activity of carbonic acid, nitric acid, etc.

Root penetration of these soils by certain plants is very limited. Therefore, certain trees growing upon these soils have a very shallow root system and when they reach considerable size, drastic wind storms up-root them. Figure 2 shows a typical example of a fine tree which was up-rooted by a storm because of its shallow root system. There are thousands of similar examples in the Northeast. It is very desirable for people landscaping for homes, planning reforestation, parks, etc. to give consideration to the type of soil and to plant the type of trees and plants that are capable of growing satisfactorily on these soils. The use of such trees as the sweet gum for shade trees in landscaping has received almost no attention on these poorly drained soils, yet they do very well on them. The improper use of plantings in landscaping on these soils often results in considerable expense due to property loss when these plantings are uprooted.

Plenty of Moisture . . .

(*From page* 20)

root-clay contacts with greater soil masses of fertility.

The corn crop this season indicated that the surface soil was not deep enough and was insufficiently stocked with fertility, at least with potassium, to balance the good supply of water. The weather was ample but our provision of fertility was not enough to make most use of that good weather.

When the yields as bushels per acre, and the shelling percentages of the present corn crop as a whole are summarized, we shall in all probability conclude that during the season of 1950 there was plenty of soil moisture but not enough soil fertility. We must then confess that we have not made maximum use of the opportunities naturally given us.

Sugar Cane and the Soil

(*From page* 26)

general one recommended by the Agronomy Department of the Agricultural Experiment Station after conducting statistically significant field experiments.

The limiting element in sugar cane fertilization is usually nitrogen. This fact is apparently true for all sugar cane areas of the world. Considering the fact that sugar cane is not grown for fruit or seed, but rather for its plant juices, the high demand for nitrogen is not too surprising. Nitrogen is essential for the production of the succulent meristematic tissue where the synthesis of sucrose from CO_2 and H_2O takes place.

The demand for phosphorus by sugar

cane is not too great, for the synthesis here is one of a growing plant and not of a plant having reached maturity and devoting its energies to the production of fruit or seed. This low phosphorus demand of sugar cane has been noticed many times by the lack of response to phosphorus fertilizers in almost all Puerto Rican soils.

The demand for potassium is next to that of nitrogen. Here again the particular purpose for which sugar cane is grown dictates this demand. The potassium is needed in the synthesis of the sucrose. Although not an actual constituent of sucrose, it is believed by many plant physiologists to be essential in the translocation of plant foods, especially starches and sugars.

Not to be overlooked is that not all of the plant food is being taken away by the harvested sugar cane. Although the cane is removed, the trash and the roots are left behind. The organic material from the sugar cane trash and roots as it undergoes humification and finally mineralization gives a steady, readily available supply of both major and minor plant nutrients. An examination of Table II shows that for every 40 tons of cane harvested, there are returned to the soil by the trash alone about 55 pounds of NH_3, 15 pounds of P_2O_5, and 25 pounds of K_2O. This is equivalent to 500 pounds of a 15:3:5 fertilizer and here the phosphorus is in the organic form and is more available than as superphosphate.

The need of special attention to minor element fertilization for sugar cane has not arisen as yet. There seems to be no noted general demand of this crop nor any marked deficiencies of any minor element. In view of the extensive root system developed and the long period of its growth (one to two years), the lack of response to minor element fertilization is not too surprising. The fine extensive root system mingling intimately with the mineral and colloidal soil particles extracts from the soil body the small but necessary amounts of minor elements needed for satisfactory growth.

In summarizing this brief glimpse at some of the relationships between sugar cane and the soil, the following items are outstanding:

1. Sugar cane does not deplete the soil of its organic matter content if the cane is well fertilized, and all plant residues are returned to the soil. The constant addition of sugar cane trash to the soil has apparently maintained a good equilibrium level with the soil organic matter content in many situations.

2. The incorporation of the sugar cane trash and the sugar cane roots serves to preserve or improve the physical condition of the soil by improving aeration, preventing erosion, and increasing the water-holding capacity.

3. Nitrogen is the largest single element removed by the harvested sugar cane. Nitrogen is also the major limiting factor for yields in sugar cane fertilization.

4. The demand for phosphorus by sugar cane is low. The potassium requirement for cane is above that of phosphorus in Puerto Rican soils.

5. The vigorous root system and length of growing season prevent any readily noticeable minor element deficiencies in sugar cane.

6. The mineralization of the large amounts of organic material contributed by the trash and roots provides a very available form of phosphorus, nitrogen, potassium, and minor elements.

Sugar cane, in return for proper fertilizer application and management will provide a highly remunerative cash crop of sugar, add organic matter to the soil, and help maintain good soil structure. It is no wonder, therefore, that this crop is one of the leading economic crops of the tropics.

* * *

Bootblack: "Shine your shoes, mister?"

Businessman: "No."

Bootblack: "Shine 'em so you can see your face?"

Businessman: "No."

Bootblack: "Don't blame you."

The Southeastern Farmer . . .

(*From page* 24)

fertilizers, grasses and clovers once thought unadaptable now flourish, and combinations of both new and old grasses and legumes are giving many farmers practically year-round grazing.

Strangely enough, most of the progress has been made during the past 10 years. Again using Georgia as an example, the average increase in acre production of the major crops has taken place only recently. The average acre yield of corn for Georgia in 1900 was 10 bushels; in 1925 it was 10.7 bushels; in 1940 only 9.8 bushels; but in 1949 it had increased to 18 bushels. Tobacco had an average yield of 500 pounds per acre in 1900 and 716 pounds in 1925. Fifteen years later, 1940, it had increased to only 761 pounds; but in 1947 it was 1,178 pounds per acre. Peanuts tell the same story. In 1925 the per-acre yield was 475 pounds; in 1940 only 525 pounds; while in 1947, although the acreage was more than doubled during the war years, the average was 695 pounds.

The progress in efficient production that has been made in the past few years is due to several factors. First, the farmer is taking advantage of the findings of research both old and new. These findings have already been reflected in his increased yields of crops, pastures, and livestock.

Second, more attention has been given to soil conservation. The soil conservation program started in 1937 is beginning to show in increased yields. The establishment of terraces and outlets for water control, the planting of soil-improvement crops, and proper land use have to a large measure retarded erosion and added new vigor to the soil.

Fig. 3. A regional grass conference tour on which farmers and others view the results of improved practices.

Third, the increased use of farm machinery has enabled the Southeastern farmer to do a better job. The number of tractors in Georgia has increased from 9,327 in 1940 to approximately 40,000 in 1949. The use of machinery is increasing livestock production. The corn and small grains which formerly were fed to mules are now going into beef cattle, hogs, and dairy cows.

Fourth, the increased yields of crops and pastures have been due in a large measure to the increased use of fertilizer. In 1940, Georgia used 768,000 tons of fertilizer; in 1947 this had increased to 1,000,000 tons; while in 1949 Georgia farmers used 1,200,000 tons of commercial fertilizer.

Fifth, tied in closely with the four factors already listed is the improved economic condition of the farmer. Too often in the past, limited finances have prevented putting into effect improved practices requiring additional capital. With higher income and more liberal credit policies, the farmer has been able to use the findings of research; he has been able to practice soil conservation measures, to buy machinery, and to buy more fertilizer. These investments have enabled him to secure more income through more efficient production.

Thus, the Southeastern farmer is increasing the production on his allotted acres. He is turning what were formerly regarded as "supply" crops into major sources of income, and he is increasing his livestock holdings. The changes made during the past 10 years, significant as they have been, will in all likelihood be dwarfed by those in the next decade.

Erosion Removes Plant Nutrients . . .

(*From page* 19)

ganic matter removed by erosion is greater than the corresponding depletion indicated by analyses of the plot soils; consequently, restoration of the original organic matter level does not compensate for losses of "reserve" organic matter.

It was estimated that erosion removed the organic matter 18 times as fast as did oxidation from a fallow plot on which the greatest erosion occurred, and that to have maintained the organic matter at the original level it would have been necessary to apply as much as 9.2 tons of clover hay annually.

Marked and significant differences in erodibility occurred in New York under a uniform treatment, following treatments which permitted great differences in the rate of erosion (8). The calculated percentages of organic matter in the soil to plow depth were found to have dropped about 0.002 per cent for each ton of soil lost by erosion.

The losses of organic matter caused by erosion in New York vary both in amount and character. They tend to be high in proportion to the total amount of soil and the proportion of fines that are lost (17).

The depth of topsoil has been found to be less important than the selective removal of certain parts of the soil by the raindrop splash process (10). An 11-year study on four soil types at Ithaca, New York, showed that soil was lost at rates varying from a trace to 138 tons per acre. Only 29 per cent of the remaining plow layer passed through a 2-millimeter screen, whereas approximately 95 per cent of the soil that was washed off passed through such a screen.

Studies in Wisconsin showed that a severely eroded soil was not only lower in organic matter and nitrogen, but lost more rainfall by runoff than did less eroded soils (9). Severely eroded Fayette silt loam had only one-third as much organic matter and one-half as

much nitrogen as moderately eroded Fayette silt loam. The severely eroded soil, when planted to grain, lost through runoff about twice as much rainfall during the growing season as moderately eroded soil. A severely eroded soil planted to corn allowed 1.3 times as much runoff as moderately eroded soil, and severely eroded soil planted to hay allowed 2.8 times as much runoff as moderately eroded soil.

Under severe erosion, eroded materials tend to approximate the composition of the uneroded soil, and the process in this case is in effect "removal layer by layer" (17). With more moderate runoff there is a selective removal of the finer particles. Small local deposits of sand on the soil surface may be swept off by later rains, but if frequent cultivation constantly presents a fresh surface to the sorting action of raindrop splash and running water, a continued removal of the finer particles may be expected.

Summary

The potential increase in agricultural output resulting from the vast improvements made in the science of crop production in past years has been offset in large measure by the damage to the soil resulting from the action of wind and water in the erosion process. The sifting and sorting action of wind and water separates the organic matter and silt and clay fractions from the soil mass and carries them from the field. The parts lost contain most of the essential plant nutrients and other life-giving substances.

Large quantities of these valuable materials may be removed from a field by the erosion process without entailing a corresponding loss of soil volume from the surface of the land. In extreme cases the soil is removed bodily. These life-giving substances usually constitute the first portion of the soil to be removed by erosion. The removal of the soil and the accompanying organic matter and plant nutrients by either wind or water erosion results in lowering the production potential of the soil.

Literature Cited

1. Bennett, H. H. Soil conservation. McGraw-Hill Book Co., Inc., 1939.

2. Bryant, Jay C. and Slater, C. S. Runoff water as an agent in the loss of soluble materials from certain soils. Iowa State College, Jour. of Sci., 22:3, 260-297. 1948.

3. Daniel, Harley A. and Langhan, Wright H. The effect of wind erosion and cultivation on the nitrogen and organic matter content of soils in the Southern High Plains. Amer. Soc. Agron. Jour. 28:587-596. 1936.

4. Duley, F. L. The loss of soluble salts in runoff water. Soil Sci., 21:401-409. 1926.

5. Finnell, H. H. Monthly progress report, Soil Conservation Service, October 1949.

6. Fippin, Elmer O. Plant-nutrient losses in silt and water in the Tennessee River system. Soil Sci., 60:223-239. 1945.

7. Fly, Claude. A preliminary report of the chemical and mechanical analyses of dust deposited by wind at Goodwell, Oklahoma. Panhandle Agr. Exp. Sta. Bul. 57. 1935.

8. Free, George R. Evidence of the effect of erosion on the organic matter and erodibility of Honeoye soil Amer. Soc. Agron. Jour., 38:207-217. 1946.

9. Hays, O. E. and Muckenhirn, R. J. The effect of depth of surface soil and contouring on crop yields. Soil Conserv. Serv. and Minn. Agr. Exp. Sta. Mimeo. 1944

10. Lamb, John, Jr., Carleton, Everett A., and Free, George R. Effect of past management and erosion on fertilizer efficiency. Paper presented at Soil Sci. Soc. Amer. Meeting. November 17-20, 1947.

11. McHargue, J. S. and Peter, A. M. The removal of mineral plant food by natural drainage waters. Ky. Agr. Exp. Sta. Res. Bul. No. 237 1921.

12. Millar, C. E. Studies on virgin and depleted soils. Soil Sci., 16:433-448. 1923.

13. Neal, O. R. The influence of soil erosion on fertility losses and on potato yields. Amer. Potato Jour., 20:57-64. 1943.

14. Powers, W. L., Jones, J. S., and Ruzek, C. V. Composition, rating, and conservation of Willamette Valley soils. Ore. Agr. Exp. Sta. Bul. 365. 1939.

15. Rogers, H. T. Plant-nutrient losses from a corn, wheat, clover rotation on Dunmore silt loam. Soil Sci. Soc. Amer. Proc., 6:263-271. 1941.

16. Slater, C. S. and Carleton, E. A. The effect of erosion on losses of soil organic matter. Soil Sci. Soc. Amer. Proc., 3:123-128. 1938.

17. Slater, C. S. and Carleton, E. A. Variability of eroded material. Jour. Agri. Res., 65:209-219. 1942.

18. Stauffer, R. S. Runoff, percolate, and leaching losses from some Illinois soils. Amer. Soc. Agron. Jour., 34:830-835. 1942.

19. Wooley, J. C. Fertility losses as a basis for erosion control planning. Agr. Engin., 24:377-379. 1943.

Surveying the Results

(*From page 9*)

is whether or not a farmer has silage. Lately, the matter of grass silage has received considerable emphasis because it is believed that for the highest success in the new pasture pattern the first crop, if not pastured, must be cut early for hay. To get this crop off at the proper time often means making grass silage if the weather is bad. Otherwise, if the crop isn't cut on time, the ladino will be shaded out and the second crop will be seriously interfered with; or if it is cut during poor haying weather, it may be partially spoiled during the curing process. Knowledge of these facts has brought a tremendous upsurge in the tonnage of grass silage which is being made on our farms.

It will be noted from Table IV that much more emphasis was placed upon silage by the high and intermediate score groups than by those in the low score group. Actually, the amount of silage available for each animal unit in the two higher scoring groups was twice as great as in the low score group. Furthermore, the average man in the two high scoring groups made about three times as much grass silage as the farmers in the 60-69 score group. This fact alone might account for differences in farmers' scores, since judging is done in mid-July when fields harvested early for grass silage would have second crops that showed up well for midsummer pasture or for second cuttings of hay. If taking off the first crop had been delayed by poor haying weather, second crops on those farms would not look so well. The success of the whole improved pasture program with ladino hinges on getting the first crop harvested early, at a time when its feeding value is at its height, and in time so that a good second crop will be produced.

It is interesting to note that in these groups the men having the highest scores had more silos and made more grass silage. Out of the top group, all but four farmers made silage, whereas in the second and third groups, seven and thirteen farms, respectively, were without silos. In the top group, of those making silage, ten men made corn silage exclusively, four made grass silage exclusively, while six made both corn and grass silage. In the intermediate group, twelve made corn silage, and five made grass silage exclusively, while two made both corn and grass silage. In the low scoring group, ten men made corn silage, three made grass silage, while two men made corn and grass silage. It was in this group that almost half of the men were without silos. This fact alone undoubtedly had a bearing on the grain to milk ratio and upon the returns to the farmer, as further data will show.

All of the farmers in all of the score groups made new seedings, pastured nurse crops, pastured new seedings, used field land for pasture to a greater or lesser degree, and all of them did a good deal of topdressing. Farmers in the top score group did more topdressing after the first crop had been removed than the farmers in the lower score group.

What we really have been trying to determine, aside from differences in practices, is the relation between these practices and the feeding program on the farm, as well as the relationship between grain costs and milk sales, or shall we say, the profitability of the venture.

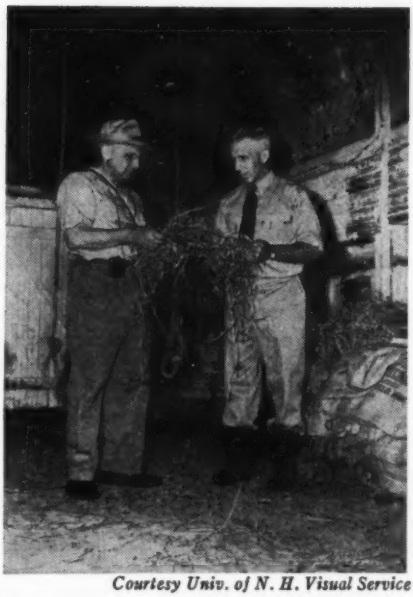
These factors are portrayed in Table V, which indicates a direct relationship between the score the average farmer received and the amount of grain he fed not only during the pasture season but for the year as a whole. The data indicate that farmers in the top group produced 5.97 pounds of milk for each pound of grain fed during the summer, those in the intermediate group produced 5.62 pounds of milk for each pound of grain, and those in the lower

group got but 4.51 pounds of milk for their pound of grain.

For the season as a whole, the differences are not quite so wide as might be expected, averaging 3.97, 3.78, and 3.34 pounds of milk for each pound of grain in the respective groups.

This is the first time that we have tried to find out the differences in the practices and methods among the different score groups in the Green Pastures Program. Naturally, we have been vitally interested in the impact of the program on the feeding practices and particularly upon how profitable such a program is to the farmer. New England is a region in which dairying for the production of market milk is an important enterprise. Very little grain is produced in the area so that it is necessary for each farmer to purchase the concentrates which are necessary to feed to supplement the roughage he grows on his farm. Quality roughage, which includes good pasture and silage and high quality hay, can cut the amount of grain that it is necessary for a farmer to buy. That, apparently, is being done as evidenced by the returns in milk sales for each dollar invested in grain (last line Table V). Farmers in the high scoring group sold $3.86 worth of milk for each dollar spent for grain, those in the intermediate group received but $2.92 for their grain dollar, and those in the low score group got back only $2.58 for each dollar spent for grain. These figures cover the entire year's operation and not just the pasture season alone.

This, then, is the pay-off. Whether a farmer has almost $3 over and above each dollar he spends for grain ($2.86 for the top group) or whether he has only a little over $1.50 ($1.58 for the low score group) may mean the difference between a highly profitable business or one in which the farmer is just "getting by." It should be remembered, too, that a relatively large group of farmers who enrolled failed to make a "passing grade" of 60 in the Green Pastures Program. Furthermore, large numbers of dairymen for one reason or another did not enroll. We suspect that many farmers did not enroll because they believed their present pasture and roughage practices would not



Courtesy Univ. of N. H. Visual Service

Fig. 3. Examining the quality of hay on the Bodwell farm: Ray Moser, Mass. judge and Guy Angell, N. H. judge.

TABLE V

	Score Groups		
	85–100	70–84	60–69
Av. grain-milk ratio on pasture	1:5.97	1:5.62	1:4.51
Av. grain-milk ratio for year	1:3.97	1:3.78	1:3.34
Ratio of grain costs to milk sales	$1:$3.86	$1:$2.92	$1:$2.58

qualify them for a high score, although this was not true in all cases.

Results obtained by the survey method are often criticized, especially when they are reduced to averages. We do not hesitate to admit that these data are open to criticism on that score. We do believe, however, that the data serve to emphasize a trend toward steps which farmers can take to make their dairy business more profitable. These differences which seem to prevail between the different score groups, such as the greater dependence of the high scoring group upon increased use of fertilizers and upon more ladino clover and alfalfa, appear to be significant. Likewise, the greater use of silage in the top two groups of farms as compared with the low scoring group probably made a difference not only in the score but also in the financial returns these low scoring farmers received.

These are ways in which the Green Pastures Program can be made to have some influence on the dairy business of New England in the future. And, we believe it will result in sounder farm operations if these significant points are followed.

Higher Fertilizer Applications . . .

(*From page* 12)

clover plants will make a strong, vigorous start in the early part of the growing season and thus withstand considerable competition by a rather heavy growth of straw. Isn't it true that on virgin land you can grow straw shoulder high and still your seedings of clover or alfalfa usually come through in good shape? Table III tells the story for nitrogen.

I know that there are a lot of experiment station workers who still think it's dangerous to recommend the use of nitrogen fertilizers. They argue that once a farmer gets a taste of what nitrogen will do, he will forget about the more fundamental approach via the route of abundant legume production. But how many farmers in Wisconsin or any other state have arrived at this long-time objective where every acre of his cropland will produce top yields of corn and grain? Not many, and the smart farmer isn't going to wait from 5 to 10 years to get that "back 40" up to the 100-bushel-per-acre level of production by the long route of lime, phosphate-potash, and

TABLE III.—AVERAGE YIELDS FOR 210 GRAIN PLOTS (MOSTLY OATS)—1945, '46, '47, '48, '49, AND '50 WHERE A COMPARISON WAS MADE OF 0–20–0 WITH 0–20–20, WITH AND WITHOUT AMMONIUM NITRATE. (AMMONIUM NITRATE APPLIED AS A TOP-DRESSING AT AVERAGE RATE OF 95 POUNDS PER ACRE AFTER SEEDING).

Treatment (average for all plots) (mostly oats, some barley & wheat)*	Yield per acre grain	Yield per acre straw	Bushels increase grain	Pounds increase straw	Value of increase grain & straw	Cost of fertilizer	Net profit per acre
340# of 0–20–0	54.2 bu.	2321#	8.4	316	$7.67	$5.44	$2.23
340# of 0–20–0+95# am. nitrate	63.1	2899	17.3	894	16.52	9.16	7.36
340# 0–20–20	57.5	2519	8.7	514	8.50	9.34	−.84
340# 0–20–20+95# am. nitrate	66.9	3192	21.1	1187	20.44	13.06	7.38
No fertilizer	45.8	2005	.....	.....	.....	.....	.....

* Grain figured at average value of 80 cents per bushel; straw at $6.00 per ton.

legumes. Rather he is going to take a short cut to high yields by applying some nitrogen fertilizer on his grain, corn, grass hays and pasture.

I'm not worried at all that our farmers will "sell out" to a program of nitrogen only. The dairy farmer will continue to grow legumes as his chief source of protein feed—and in the wake of bigger crops of alfalfa, clover, and ladino will come better crops of corn, small grain, and truck crops.

A Toast to the Holidays

(*From page* 5)

improvements nil. But they have the radio and the picture show, the telephone and the motor car, electricity and fancy tax bills. A returning native couldn't startle them much, even if he had been on a government mission to Mars. No, to get a real picture of the privations and simplicities of 1900, you'd have to go back and roust out some of the men who bossed our community in the days of William McKinley and Tama Jim Wilson. You might have a real time finding them, but if you drank the right article frequently, dreams of other years and other leaders would briefly return for your holiday edification. Never mind the headache later on.

Well, let's be off. When the "fast mail" drew into the seedy old station built in civil war days, I'd grab my bag and hunt hard for a taxi. All I could see in the blizzard would be a row of hotel hacks ruefully waiting to catch some unlucky holiday wayfarer doomed to spend Christmas away from his family. So I'd have to walk or else seek the dubious comfort of the village hotel until Dad got into town with the horse and cutter.

No matter how long I'd sit there in the queer old lobby, with its big walnut archways and huge desk where you signed up on a whirling register, Dad wouldn't come while the drifts piled up along the narrow, rutted roads. I'd have to stay there and partake of a solitary meal in the cold, gas-lit dining room, with nary a happy drummer to keep me company in the holidays. I couldn't even telephone out home to say hello and best wishes, it being the whoop and holler days.

Maybe next morning—Christmas day and a white one—Dad would finally hove into sight coming down the lumpy street, the bells on the cutter shafts tinkling cheerily under the patient motion of shaggy old Pike, the white gelding I learned to cultivate with. I'd wrap up snug in the old buffalo robe and take that hour's slow jingle-bell journey through alabaster fields of unbroken extent. At last the smoke signals and the familiar roofs would tell us we had arrived at the paternal home haven. Isolated yet majestic, remote but ever remembered.

There every task would be done by hard handwork. Mother's big kitchen would smell of all the tasty recipes she knew so well that we loved and enjoyed. She would come to meet us smoothing her hair and fumbling at her apron strings. She would apologize about being behind in her preparations, owing to her helping a young neighbor lady birth a boy. Doc Kellogg, you see, was unable to play the stork because no word could be sent to him in such a heavy storm, and anyhow the roads were blocked for miles.

After we thawed the pump and fetched in enough water, Dad and I would struggle through the snow to the barn to feed the stock, chuck down the hay, and toss out the accumulated manure. It would be dark by late afternoon, so that lanterns would be used in the stable to help us grope

around and back in the house Mother would clean and refill the kerosene lamps so she could see to wash the dishes with water heated on the range.

During this session with daily tasks I wouldn't dare remark about all the electric gadgets and handy phones we had at our place, or the radio we could turn on—or off—or about television showing us how the President looked or how Santa Claus hitched up his reindeer. All we could do in the evening would be to read Dickens' famous Scrooge story again under the hanging lamp that drew down on a chain close to Dad's easy chair. Then we'd stop to recall old holidays with those who'd never spend them with us again. Finally we'd throw some more buck-sawed oak chunks through the heater door, sweep up the bark and chips on the zinc, and get ready for repose in a clean but clammy bed in those chilly upstairs quarters.

TO while away the hours in the community, some conversation would be necessary. Maybe you'd be interested in organizations. So you'd just ask Dad how the Grange was getting along. He'd reply that they were just keeping alive and that's all and that some of the members were shouting for a state cooperative law and urging the Grange to stir up a ruckus about new farm marketing associations. The neighboring farmers would drop in and say that agriculture was getting the short end. What really happens in the dark, with middlemen's margins growing? There would be signs of unrest.

Downtown the blacksmith, the tinker, the depot agent, and the drayman would all be discussing the growth of these here new labor unions. They'd heard tell about their doings and all they promised to do with wages and shorter working hours—a kind of continuous Christmas. But they'd be danged about joining yet, because the dues were too stiff.

Many farmers would jump the government for neglecting agriculture. All the attention the ruralites got, they'd argue, was to get post-office packages of free seeds and envelopes with circulars on cattle ticks and bovine tuberculosis. Why should a stockman fuss about normal losses anyhow? Science wouldn't work well on a farm. What we need are ways to make more net income and get ahead with less hard work and debt, they'd exclaim. Experts from the state, snooping around our barns and privies, are of no blasted value to farming, they'd conclude.

Would it be sensible and diplomatic for me to break in right there and carefully inform and instruct these backward farmers about the power and the prestige of so many organizations you couldn't even keep track of them? Could I tell them about the influence on state and federal affairs held by strong farm organizations, some in rival camps? How could I begin to explain about the large-scale processing and marketing co-ops that dominate many regions and numerous commodities? How describe to them the widespread labor union setup, reaching down to the hired man and the truck driver? Would they believe that elections and laws would easily be decided by the membership in these organizations, reached daily by movies, by radio, and by television?

Going further, pray in what way could I go into the devious and complex sections and amendments to the domestic allotment and price-support law for agriculture? How could I keep a straight face or risk a fight in trying to tell these incredulous folks about the taxpayers' losses with potatoes, powdered eggs, and butter? How to introduce them to government crop insurance, or guaranteed loans to build grain bins? I'd rate as a fancy dan with need of more steam in the cylinders and less in the exhaust.

Verily, saith the preacher, these long years have brought us some innovations which are not simple to justify or defend before a practical jury as unbiased and open-minded as those farmers at the turn of the century would be—if they'd listen without thinking me in-

sane. Such mixed blessings of the present era would be balanced off, of course, by a multitude of changes and improvements that make for better thinking, better farming, and better living. As it is with all of life's destiny, you take the good with the bad—and when you simmer it down you'll usually find the former more frequent than the latter, in America anyhow.

WELL, it's a "fur piece" to go, back there in memory to the holidays with their holly ways. As I get along myself in the scroll of experience, I find it harder to visualize all that we underwent and undertook, which made each year's Christmas eventful and meaningful. We did not have to halt and pause in preparations to listen for the crash of a possible bomb laid on the necks of homebodies, or scan each newspaper with dread of some new and entangling alliance or face-saving necessity. The sad part of our reactions these days lies in the fact that all this open-handed generosity and good will we have exhibited seems to have come home to roost as buzzards, not doves.

We honestly wanted to see the doves again. We had not a single hanker for the company of buzzards. That was not what we settled for with the foreign world we are trying to understand and "brother with." We'd rather spend our Christmas pin-money for useful and helpful gifts, instead of having it frittered away for shooting irons.

But it's not our fault and not your fault that we must divide our Christmas devotions with thoughts of alarm and dismay. If peace on earth and good will towards all men must be purchased with the sorrow and loss of three generations since the turn of the century, its ultimate attainment will be worth the suffering, the pain, and the glory.

And now, once more, the bells, the toys, and the prayers—dreams of a world as serene as the world of long ago. For all this we have come far to seek, and with God's help, we shall find it.

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Young Hubby (helping arrange new furniture): "There, that twin bed looks fine over in the corner. Now I'll see if I can get one of the neighbors to help me put the other one where I want it."

Young Wife: "Why, where do you want it, dear?"

Hubby: "In the attic."

* * *

We like a party on New Year's Eve
Which has an informal tone;
A merry group of our warmest friends
At any house but our own.

* * *

Said a teacher in South Dakota: "I wonder if any of you children have Indian blood?" "I have," answered little Johnny. "That's very interesting," said the teacher, "What tribe?" "Oh," answered Johnny, "it wasn't exactly a tribe, just a wandering Indian."

* * *

Two old maids went for a tramp in the woods. The tramp escaped.

* * *

A farmer's barn was burned down and the agent for the insurance company told him that his firm would build another exactly like the one destroyed instead of paying the claim in cash.

The farmer was furious. "If that's the way you do business," he roared, "you can cancel the insurance on my wife!"

"Yes sir," he said, "the morning glories are so bad in that south corn field of mine that I can take hold of one corner and shake the whole field."

* * *

The waitress watched as the customer put eight spoonfuls of sugar in his cup of coffee and proceeded to drink it without stirring it first.

"Why don't you stir it?" she asked.

The customer regarded her coldly and said, "Who likes it sweet?"

* * *

A man was perched atop one of Atlanta's highest buildings, contemplating suicide, and a policeman had made his way to the roof to try and persuade the man not to jump. "Think of your mother and father," pleaded the officer.

"Haven't any."

"Think of your wife and children."

"Haven't any."

"Well, think of what your girl friend might think."

"I hate women."

"All right, think of Robert E. Lee."

"Who's he?"

"Go ahead and jump, you damn Yankee!"

* * *

Physician: "Lady, if you want a health examination you'll have to remove your blouse."

Kitty: "Oh, no, doctor!"

Physician: "Come, come! Don't make mountains out of mole hills."

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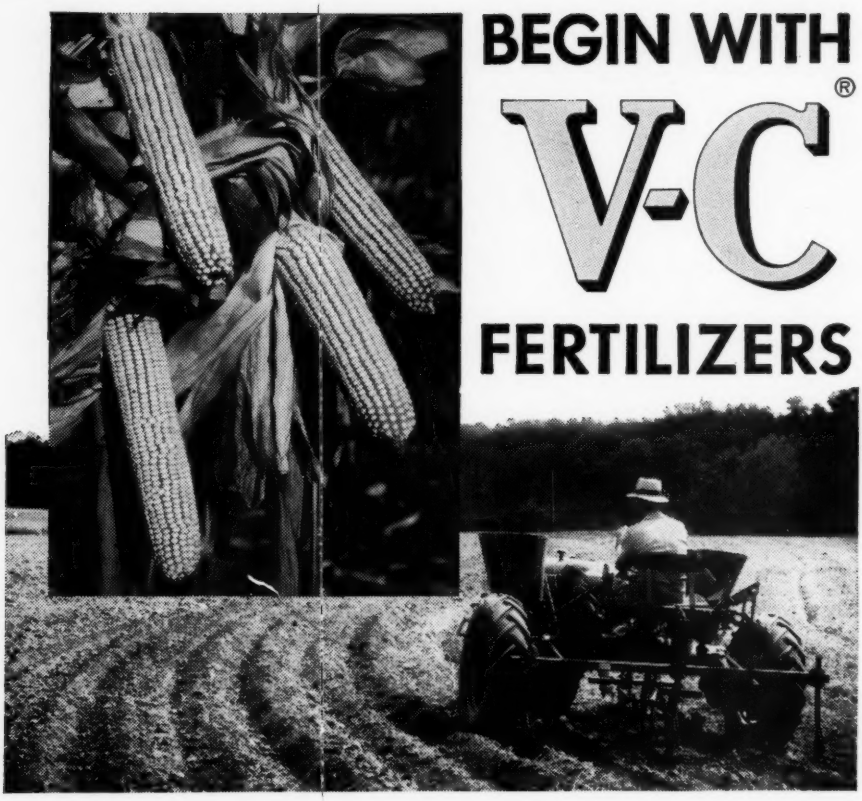

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